

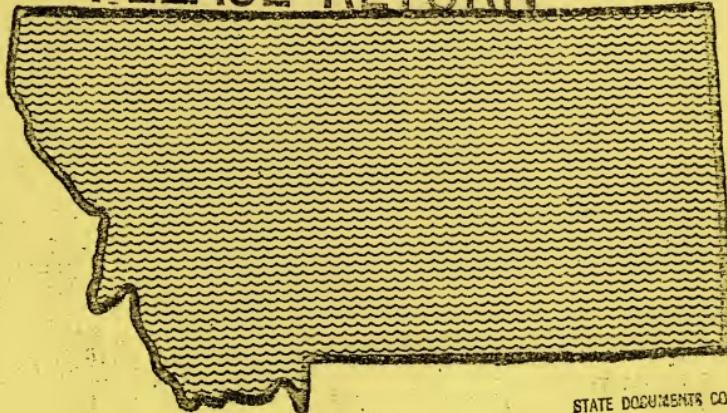
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WATER AND HAZARDOUS MATERIALS

POLLUTION CONTROL CONTINGENCY PLAN

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OIL AND HAZARDOUS MATERIALS
POLLUTION CONTROL CONTINGENCY PLAN

MONTANA STATE DEPARTMENT OF HEALTH
AND
ENVIRONMENTAL SCIENCES

ENVIRONMENTAL SCIENCES DIVISION
WATER QUALITY BUREAU

HELENA, MONTANA

FEBRUARY, 1974



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OIL AND HAZARDOUS MATERIALS
 POLLUTION CONTROL CONTINGENCY PLAN

PURPOSE

The Federal Oil and Hazardous Materials Pollution Contingency Plan, (November 1971) was promulgated under provisions of the Water Quality Improvement Act of 1970 and is applicable to all waters of the United States. In addition to this federal plan, individual state plans are required by federal law. State plans will supplement the federal plan.

LEGAL OBLIGATION

Montana Law

Under the provisions of Section 69-4805, R.C.M. 1947, the Department of Health and Environmental Sciences is charged with the public obligation of protecting water quality in Montana. A portion of the law under which the department acts states it is unlawful to pollute any state waters or place wastes in a location where they are likely to cause pollution of any state waters (Section 69-4806, R.C.M. 1947). Violators are subject to a civil penalty not to exceed \$10,000, and each day is considered a separate offense. Where a person willfully violates Section 69-4806, R.C.M. 1947, he shall be subject to a fine not to exceed \$25,000 per day of violation or imprisonment not to exceed one year or both. Following an initial conviction for a criminal violation, subsequent criminal convictions will subject a person to a fine not to exceed \$50,000 per day of violation, or imprisonment for not more than two years, or both.

Montana law further provides that in a civil action the department may ask for and the court is authorized to assess a violator for the cost of investigation or monitoring survey which lead to the establishment of the violation or any expense incurred by the state in removing, correcting or terminating any of the adverse effects upon water quality resulting from the unauthorized discharge of pollutants.

Federal Law

The Federal Water Pollution Control Act Amendments of 1972 provide:

1. Failure to report a discharge into or upon the waters of the United States or adjoining shoreline by the responsible party may result in civil penalty of up to \$10,000 for each offense, a maximum of one year imprisonment, or both.
2. Anyone responsible for a discharge into waters is subject to a civil penalty of up to \$5,000. No distinction is made between negligent and deliberate discharges.
3. When the discharge has been partially or wholly caused by negligence, cost of cleanup is borne by the responsible party up to \$8,000,000 on inland waters.
4. Full cleanup costs are borne by the responsible party when the discharge is deliberate.

STATE RESPONSIBILITY

The Department of Health and Environmental Sciences will assume the lead agency role for contacting other departments and water users which may be affected by a spill. This department will also work closely with oil spill cleanup cooperatives* by monitoring cleanup efforts, providing technical assistance and deploying department personnel. The health department will also serve as a liaison of the Regional Response Team (Federal Register, December 21, 1972).

Pursuant to Section 311 (c) (2) (H) of Public Law 92-500, the state may act where necessary to remove a discharge of oil or hazardous substances and may be reimbursed from the federal pollution revolving fund reasonable costs incurred in such removal. However, the state must have approval prior to the use of the funds. Prior approval is obtained from the Thirteenth District U. S. Coast Guard Office (Seattle) through the predesignated on-scene coordinator for EPA, Region VIII.

REPORTING PROCEDURE

The procedure which will be followed in reporting a spill is schematically shown in Figure 1. Any spill which does or is likely to enter any surface or underground waters of the state must be reported immediately to the following:

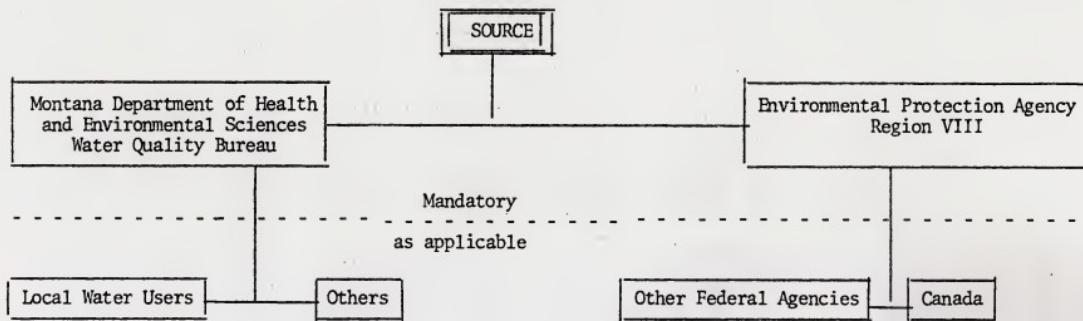
U. S. Environmental Protection Agency
Region VIII
Denver, Colorado 80203
Phone: (303) 837-3880 24 hours

Department of Health and Environmental Sciences
Environmental Sciences Division
Water Quality Bureau
Helena, Montana 59601
Phone: (406) 449-2406
See page 5 for off-duty hours

In addition, the spill report form, page 4, must be completed and sent to the Department of Health and Environmental Sciences within ten days.

*The Montana-Wyoming Oil Control Coordination Committee, a cooperative of eleven Montana pipeline companies and four refiners was formed in May 1972. It is the first in Montana. The cooperative is headquartered in Billings and serves southern Montana and the Big Horn Basin of Wyoming. Other cooperatives are expected to form.

FIGURE 1
REPORTING SCHEMATIC



Mandatory
as applicable

Department of Natural Resources and Conservation
Fish and Game Department
Department of Highways
Department of Law Enforcement and Public Safety
Department of Agriculture
Department of Military Affairs (Civil Defense)
Petroleum production and pipeline companies
Liquid and dry bulk haulers
Railroad companies
Montana oil spill cleanup cooperatives

SPILL REPORT FORM

I. Reported by:

1. Name _____ Phone No. _____
2. Address _____
3. Date and time first noted _____
4. Other information _____
5. Date and time of report _____

II. Location:

1. Stream or watercourse _____
2. Town _____ County _____
3. Landmark _____
4. Legal description (Township, Range, Section, Tract) _____

III. Pollutant:

1. Pollutant material _____ Amount _____
2. Area or miles affected _____
3. Describe effects (color, slick, dead or dying fish, etc.)

IV. Responsibility:

1. Person or entity: Name _____
2. Address _____
3. Phone No. _____

V. Describe cleanup procedures used:

VI. Cause:

VII. Persons notified:

APPENDIX A

DIRECTORY

ENVIRONMENTAL PROTECTION AGENCY, U. S., Region VIII, Denver, Colorado 80203

Spill Reporting

Richard M. Jones, Dr. George Rice, Floyd Nichols, Al York, Pete Larson.
(303) 837-3880 - 24 hours

MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

Division of Environmental Sciences
Water Quality Bureau
Helena, Montana 59601 (State office)
Phone: (406) 449-2406

Mr. Braico will be Montana's primary representative on the Regional Response Team. Mr. Jankowski will be his alternate.

Off-duty hours:

Robert D. Braico
Public Health Engineer
Home: (406) 442-0923

~~Walter A. Jankowski~~
~~Supervisory Chemist~~
~~Home: (406) 442-5233~~

Abo. Hore

(406) ————— 458-9266

~~Maxwell K. Botz~~
~~Public Health Engineer~~
~~Home: (406) 933-5954~~

~~Donald M. Zollman~~
~~Public Health Engineer~~
~~Home: (406) 488-5469~~

Steven L. Pilcher
Sanitarian
Home: (406) 443-2345

Donald G. Willems, Chief
Water Quality Bureau
Home: (406) 442-9722

Arthur W. Clarkson
Public Health Engineer
Home: (406) 442-7213

MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES (continued)

P. O. Box 1031
Kalispell, Montana 59901 (Flathead regional office)
Phone: (406) 756-5521

Off-duty hours:

David A. Nunnallee
Branch Engineer
Home: (406) 752-3915

Wilbur O. Aikin
Public Health Engineer
Home: (406) 752-1866

P. O. Box 20296
Billings, Montana 59103 (South central and eastern Montana regional office)

Off-duty hours:

Alf Hulteng
Branch Engineer
Home: (406) 259-9285

Richard Karp
Chemist
Home: (406) 656-8398

CANADA (Contacts for spills crossing border)

ENVIRONMENTAL PROTECTION SERVICE (Federal)

Robert K. Pettegrew
Environmental Emergency Branch
Environmental Protection Service
10025 Jasper Avenue
Edmonton, Alberta T5J 2X9
Office: (403) 425-5128
Home: (403) 487-1529

Alternate:

Bryon Mansfield

Provincial

Alberta

Saskatchewan

CANADA (continued)

Provincial

British Columbia

Municipal and industrial surface water users who may be affected by a spill will be contacted by the Department of Health and Environmental Sciences personnel. However, this does not preclude action by other parties when earliest possible notification is critical.

Municipalities with surface water supplies, county sanitarians and industrial surface water users are listed in tables 1, 2 and 3, respectively. Locations of municipalities and industries are given in figures 2 and 3, respectively.

The area code for Montana is 406.

TABLE 1. MUNICIPALITIES WITH SURFACE WATER SUPPLIES

<u>COMMUNITY</u>	<u>SOURCE</u>
ALBERTON	Spring
Mrs. Dorothea Smith Town Clerk Home: 722-3392	
Leo Kinney Water Superintendent Home: 722-3348	
ANACONDA	Warm Springs Creek
C. Wayne Young, Manager Butte Water Company Office: 563-7111 Home: 792-9532	
Jack Carraher Home: 563-3459	
ANACONDA (Job Corps)	Warm Springs Creek
Camp Director Office: 563-3476	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

COMMUNITY

SOURCE

BASIN

Basin Creek

Del Bullock
Water Superintendent
Home: 225-3260

BEARCREEK

Bear Creek

Joe Janskovitch
Water Superintendent
Home: 446-2385

BILLINGS

Yellowstone River

Vern Troy
Director of Public Works
Office: 248-8511
Home: 259-7961

John Voelker
Office: 248-7511
Home: 656-5410

BOZEMAN

Lyman Creek
Sourdough Creek
Hyalite Creek

Harold Fryslie
City Manager
Office: 586-2366
Home: 587-7737

Arthur Van Hult
City Engineer
Office: 586-2360
Home:

Ralph Dunahoo
Water Superintendent
Office: 587-8266
Home: 587-3449

BRADY

Irrigation Ditch

Dick Sangray
Water Superintendent
School: 753-2392
Home: 753-2203

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

COMMUNITY

SOURCE

BROWNING

Springs

Vern Hartford
Town Clerk
Office: 338-2060
Home: 338-3311

Ed Aubert, Mayor
Office: 338-2344
Home: 338-3430

BUTTE

Basin Creek
Moulton Creek
Big Hole River near Divide

C. Wayne Young, Manager
Butte Water Company
Office: 792-2311
Home: 792-9532

CASCADE

Springs

T. E. Coulson
Water Superintendent
Home: 468-2569

Mary Nicholson
Town Clerk
Office: 468-2808

CHESTER

Tiber Reservoir

Dale Muncy
Water Superintendent
Office: 334-3631
Home: 334-5791

CHINOOK

Milk River

Carl King
City Engineer
Office: 357-2120
Home: 357-3312

CHOTEAU

Springs

James Dellwo
Water Superintendent
Office: 466-2081
Home: 466-5768

Water Department Office: 446-2510

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
CLYDE PARK	Springs

Steve Hargrove
Water Superintendent
Home: 686-4663

COFFEE CREEK	Spring
--------------	--------

Henry Neme, Jr.
Water Superintendent
Home: 567-2307

COLUMBIA FALLS	Cedar Creek Spring
----------------	-----------------------

Don Lunsford
Water Superintendent
Office: 892-3343
Home: 892-5341

COOKE CITY	Hoosier Spring Soda Butte Spring
------------	-------------------------------------

Vince Mus
Water Superintendent
Home: 838-2272

CORAM	Spring
-------	--------

Hubert Hudson
Home: 387-5392

CROW AGENCY	Little Big Horn River
-------------	-----------------------

George Minton
Indian Hospital: 638-2626
Home: 638-2214

Bureau of Indian Affairs
Crow Indian Agency
Office: 638-2671

CULBERTSON	Missouri River
------------	----------------

Maynard Cellmer
Water Superintendent
Home: 787-6655

City Clerk: 787-5227

CUT BANK	Cut Bank Creek
----------	----------------

Elmer Kennedy
Water Superintendent
Office: 938-2362 (Filtration plant)
938-2092 (City Hall)

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

COMMUNITY

SOURCE

DEER LODGE

Tin Cup Joe Creek

Tony Sneberger

Mayor

Home: 846-2678

Duane Hubbard

Water Superintendent

Office: 846-2238

Home: 846-1445

DEER LODGE (Prison)

Tin Cup Lake

Joe Vanisko

Chief Engineer

Office: 846-1320 Ext. 47

Home: 846-2246

DENTON

Springs

Cecil Linse

Mayor

Home: 567-2289

DILLON

Rattlesnake Creek

Roger Pierce

City Engineer

Office: 683-2012

Home: 683-2824

EAST GLACIER

Midvale Creek

C. W. Stevenson

Office: 226-5701

Home: 226-4171

EAST HELENA

McClellen Creek

John Verbanac

Water Superintendent

Office: 227-5321

Home: 227-5514

ESSEX

Essex Creek

John Santana (Whitefish)

Office: 862-3551

Home: 862-2156

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
EUREKA	Sinclair Creek
William Gwynn Mayor Home: 296-2216	
FORSYTH	Yellowstone River
Thomas Higginbotham Water Superintendent Office: 356-7511 Home: 356-7572	
FORT BELKNAP	Milk River
Administration: 353-2278 Field Health Services: 353-2316	
J. J. Adams Office: 353-2589 Home: 353-2749	
FORT BENTON	Missouri River
Henry Preshinger Water Superintendent Office: 622-5152 or 622-3243 Home: 622-3624	
FORT PECK	Ft. Peck Reservoir
Don Beckman Area Engineer Office: 526-3411 Home: 367-4381	
FORTINE	Deep Creek
Jerry Syth Water Superintendent Home: 822-7474	
FROMBERG	Clarks Fork River
Karl Buechler Water Superintendent City Hall: 668-7383 Home: 668-7488	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

COMMUNITY

SOURCE

GARDINER

Yellowstone River and Springs

W. R. Thomas
Home: 848-7262

GERALDINE

Springs

Don Thomas
Home: 737-4236

GLASGOW (AVCO-ESC)

Missouri River

Lloyd Sorenson
Office: 524-7541
Home: 228-4825

GLENDIVE

Yellowstone River

Chet Eyer
City Engineer
Office: 365-3318
Home: 365-5048

GREAT FALLS

Missouri River

Manager
Water Department
Office: 452-8561

City Engineer
Office: 452-8561

HARDIN

Big Horn River

M. S. Cook
Water Superintendent
Office: 665-1080
Home: 665-1450

HARLEM

Milk River

William Glenn
Water Superintendent
Office: 353-2507
Home:

City Clerk: 353-2361

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
HAVRE	Milk River
Robert Malone Water Superintendent Office: 265-9115 Home: 265-7559	
Fred Hartson City Engineer Office: 265-4941	
HELENA	Missouri River (Regulating Reservoir) Ten Mile Creek
City Manager Office: 442-6850 Home:	
Robert Newhouse City Engineer Office: 442-3404 Home: 443-3970	
HILL COUNTY WATER DISTRICT	Fresno Dam
Ed Lipp Manager Home: 397-2785	
Richard Spicher Board Member Home: 397-2480	
Clarence Een Board Member Home: 355-2475	
HOT SPRINGS	Hot Springs Creek
Laurel K. Craft Water Superintendent Home: 741-3514	
Town Hall: 741-2253	
HUNGRY HORSE	Spring Creek
Mrs. Jim Willows Home: 387-5583	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
HYSHAM	Yellowstone River
Mrs. Robert Shoemaker Town Clerk Office: 342-2701 Home: 342-2706	
KALISPELL	Spring
Carl Lauterjung Water Superintendent Office: 756-9457 Home: 756-7710	
L. B. McClintick City Engineer Office: 756-9457 Home: 756-6895	
KEVIN	Springs
Kenneth Erickson Water Superintendent Office: 337-2141 Home: 337-2311	
LAUREL	Yellowstone River
John Daley City Engineer Office: 698-4417 Home: 698-4641	
Kenneth Beven Water Superintendent Office: 698-4410 Home: 698-4693	
LEWISTOWN	Spring
Sam Burton Water Superintendent Office: 538-8768 Home: 538-5684	
City Clerk: 538-8768	
LIBBY	Floweree Creek
Gene Gaston, Manager Pacific Power Company Office: 293-4107	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
LIMA	Spring
Ken Berthelson Water Superintendent Home: 276-3528	
Ken Marier, Mayor Home: 276-3409	
Mary Poole Town Clerk Home: 276-3466	
LIVINGSTON	Yellowstone River
Ed Miller Water Superintendent Office: 222-1142 Home: 222-3218	
MANHATTAN	Spring
John Logan Water Superintendent Office: 284-3235	
MARTINSDALE	Spring
Marie B. McGuire, Secretary Water Users Association Home: 572-3613	
Stillman Jones Water Superintendent Home: 572-3614	
MILES CITY	Yellowstone River
City Engineer Office: 232-3064	
Clerk and Water Department: 232-3462	
MISSOULA	Rattlesnake Creek
Charles Pepper Division Superintendent Montana Power Company Office: 549-2301 Home: 543-8520	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

COMMUNITY

SOURCE

MISSOULA (continued)

Tom Crowley
City Engineer
Office: 728-2817
Home: 549-5322

NEIHART

O'Brien Creek

Bonnie McDaniel
Town Clerk
Office:
Home: 236-5357

Alex Schwantes, Mayor
Home: 236-5585

NOXON

Pilgrim Creek

J. F. Dobrovec
Home: 847-2321

PHILIPSBURG

Fred Burr Lakes
South Boulder Creek

Roy Hamilton
Water Superintendent
Office: 859-3821
Home: 859-3665

PLAINS

Springs

Earl Inman
Home: 826-3644

Marlin Postma
Mayor
Home: 826-3484

POLSON

Hell Roaring Creek

Leonard W. Connell
Water Superintendent
Office: 883-2131
Home: 883-2884

POLSON (Montana Power Company)

Flathead River

Office: 883-4450

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
RAPELJE	Spring
Stanley Erfle Water Superintendent Home: 663-4363	
RED LODGE	Rock Creek
Robert Phillips Water Superintendent Office: 446-1313 Home: 446-2658	
Charles Mattila City Clerk Office: 446-9944 Home: 446-1572	
RONAN	Midvale Creek
Loren Clary Water Superintendent Office: 676-4231 Home: 676-8038	
ST. IGNATIUS	Mission Reservoir
Peter Gariepy Town Clerk Office: 745-3123 Home: 745-3254	
Albert LaPorte Water Superintendent Home: 745-3881	
SALTESE	Silver Creek Packer Creek
Duane Moeller Home: 678-4239	
SEELEY LAKE	Seeley Lake
Walter McDonald Home: 677-2361	
SHERIDAN	Indian Creek Spring
James Moore Water Superintendent Office: 842-5431 Home: 842-5773	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
SILVER GATE	Spring
Henry Strecker Home:	
SOMERS	Flathead Lake
Allan Milne Home: 857-3372	
SQUARE BUTTE	Springs
Rita Peters, Secretary Water Users Association Home: 737-4360	
H. Warehime Water Superintendent Home: 737-4457	
STOCKETT	Springs
Bob Klasner, Jr. Water Superintendent Home: 736-5487	
Bob Klasner, Sr. Owner Home: 736-5464	
SUMMIT	Stream
John Santana (Whitefish) Office: 862-3551 Home: 862-2156	
SWEETGRASS	Milk River in Canada
John A. Philips. Water Users Association Home: 335-2331	
THOMPSON FALLS	Ashley Creek
Gerald Eldridge Water Superintendent Office: 827-3557 Home: 827-3440	

MUNICIPALITIES WITH SURFACE WATER SUPPLIES (continued)

<u>COMMUNITY</u>	<u>SOURCE</u>
TROY	O'Brien Creek
Robert Wickholm Water Superintendent Office: 295-4151 Home: 295-4404	
VIRGINIA CITY	Springs
Harvey Roney, Mayor Home: 843-5456	
Ruth Adams City Clerk Home: 843-5320	
J. E. Evans Water Department Home: 843-5368	
City of Virginia City: 843-5321	
WEST GLACIER	Spring
R. R. Rensel Home: 888-5663	
WHITE SULPHUR SPRINGS	Willow Creek
George Bears Water Superintendent Office: 547-3911	
Robert A. Bailey, Mayor Office: 547-3434 Home: 547-3655	
WHITEFISH	Haskill Creek (First, Second and Third Creeks) Whitefish Lake
Ben Halverson Water Superintendent Office: 862-2752 Home: 862-4089	
City Clerk: 862-2640	
Burlington Northern John Santana Office: 862-3551 Home: 862-2156	

FIGURE 2. MUNICIPAL SURFACE WATER USERS

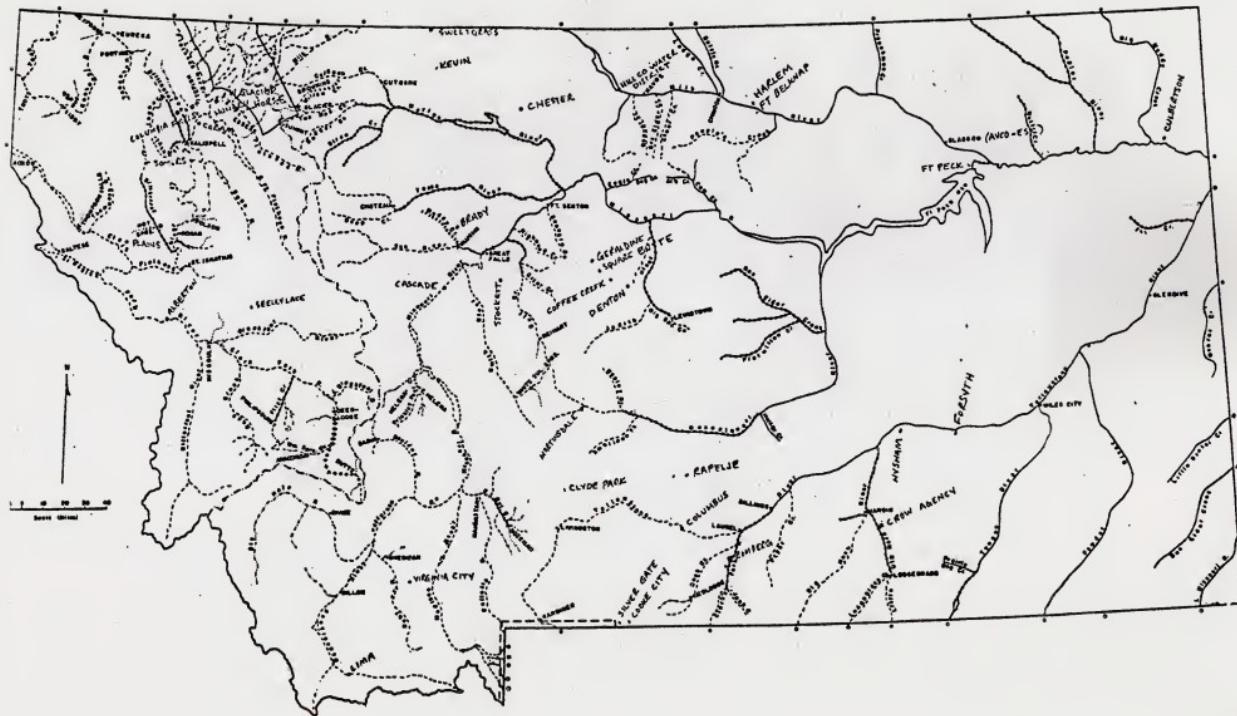


TABLE 2. COUNTY SANITARIANS

BEAVERHEAD COUNTY

Christopher Kraft
Courthouse
Dillon, Montana 59725
Office: 683-4868
Home: 683-4977

BIG HORN COUNTY

Thomas L. Lippert
Box T
Hardin, Montana 59034
Office: 665-1005
Home: 665-1156

BLAINE COUNTY

John C. Herndon
Box 504
Chinook, Montana 59523
Office: 357-3310
Home: 357-2563

BROADWATER COUNTY

(see Jefferson County)

CARBON COUNTY

(see Stillwater County)

CARTER COUNTY

(see Custer County)

CASCADE COUNTY

Jon Tovson
1130 17th Avenue South
Great Falls, Montana 59405
Office: 761-6700 Ext. 245
Home: 453-7949

CHOUTEAU COUNTY

(vacant)

CUSTER COUNTY

Brian Schoof
Courthouse
Miles City, Montana 59301
Office: 232-4786
Home: 232-1005

DANIELS COUNTY

(vacant)

DAWSON COUNTY

John C. Geach
Courthouse
Glendive, Montana 59330
Office: 365-3070
Home: 365-4511

DEER LODGE COUNTY

John D. Peterson
Courthouse
Anaconda, Montana 59711
Office: 563-7170
Home: 563-2125

FALLON COUNTY

(see Custer County)

FERGUS COUNTY

E. Richard Isern
City Hall
P. O. Box 1150
Lewistown, Montana 59457
Office: 538-8144
Home: 538-8459

FLATHEAD COUNTY

Leslie J. Espeland
Box 919
Kalispell, Montana 59901
Office: 756-9481
Home: 862-3007

GALLATIN COUNTY

L. E. Wallace
Courthouse
Bozeman, Montana 59715
Office: 587-4297
Home: 587-0179

GLACIER COUNTY

(see Teton County)

GOLDEN VALLEY COUNTY

(see Fergus County)

GRANITE COUNTY

(see Deer Lodge County)

HILL COUNTY

(see Blaine County)

JEFFERSON COUNTY
Cleve Johnson
Courthouse
Boulder, Montana 59632
Office: 225-3810
Home:

JUDITH BASIN COUNTY
(see Fergus County)

LAKE COUNTY
Al Hawkaluk
Box 1210
Polson, Montana 59860
Office: 883-4433
Home: 883-4340

LEWIS & CLARK COUNTY
Keith Trafton
201 South Main
Helena, Montana 59601
Office: 442-6230
Home: 442-2708

LIBERTY COUNTY
(vacant)

LINCOLN COUNTY
(vacant)

MADISON COUNTY
(see Beaverhead County)

McCONE COUNTY
(see Dawson County)

MEAGHER COUNTY
(see Park County)

MINERAL COUNTY
(see Missoula County)

MISSOULA COUNTY
Cliff Foy
Courthouse Annex
Missoula, Montana 59801
Office: 728-4510
Home: 258-6831

PARK COUNTY
Ray Hedrick
Box 109
Livingston, Montana 59047
Office: 222-1407
Home: 222-1605

PONDERA COUNTY
(see Teton County)

PRairie COUNTY
(see Dawson County)

RAVALLI COUNTY
Frank H. Gessaman
Courthouse
Hamilton, Montana 59840
Office: 363-4940
Home:

RICHLAND COUNTY
(see Dawson County)

ROOSEVELT COUNTY
(vacant)

ROSEBUD COUNTY
(see Big Horn County)

SHERIDAN COUNTY
(vacant)

SILVER BOW COUNTY
Don McLean
Courthouse
Butte, Montana 59701
Office: 792-0441
Home:

STILLWATER COUNTY
Rodney Fink
Courthouse
Columbus, Montana 59019
Office: 433-6438
Home:

SWEET GRASS COUNTY
(see Park County)

TETON COUNTY
Michael Clasy
Courthouse
Conrad, Montana 59425

TOOLE COUNTY
(see Teton County)

TREASURE COUNTY
(see Big Horn County)

VALLEY COUNTY
(vacant)

WHEATLAND COUNTY
(see Fergus County)

WIBAUX COUNTY
(see Dawson County)

YELLOWSTONE COUNTY
Allen Bond
Courthouse
Billings, Montana 59101
Office: 252-5181 Ext. 267
Home: 656-1520

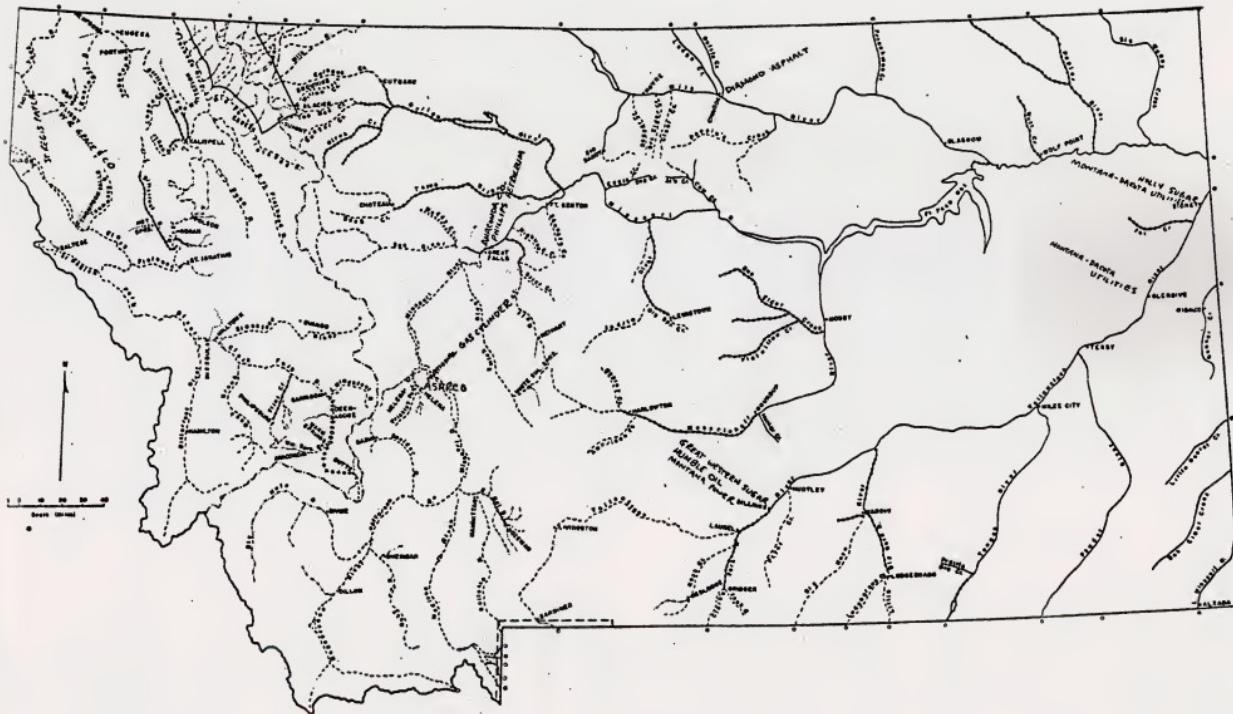
TABLE 3. INDUSTRIAL SURFACE WATER USERS

<u>NAME</u>	<u>SOURCE</u>
Anaconda Company, Great Falls Walter Dunn Office: 453-3211 Home: 453-8161	Missouri River
American Smelting and Refining Company (ASARCO), East Helena Stanley Lane Office: 227-5311 After hours: 227-5312 Home: 227-5345	Prickly Pear Creek
Exxon Company, USA, Billings Refinery: 252-3811 B. D. Nolan, Manager Home: 252-6740	Yellowstone River
Great Western Sugar Company, Billings Business Office: 245-3115 Factory Manager: 245-6393 Quality Control: 245-3713 Bill Phillips, Senior Vice President, Operations Home: 259-2341	Yellowstone River
Holly Sugar Company, Sidney Agricultural Department: 482-3309 Factory Superintendent: 482-3303 John Nigro, Plant Superintendent Home: 482-2896	Yellowstone River
Montana-Dakota Utilities, Glendive R. Amundson, Plant Superintendent Office: 365-5251	Yellowstone River
Montana-Dakota Utilities, Sidney Merrill F. Lewis, Plant Superintendent Office: 482-1613	Yellowstone River
Montana-Dakota Utilities Company, Billings Carl R. Anderson, Manager, Environmental Protection Department Office: 723-5421	Yellowstone River
National Cylinder Gas, East Helena Ed Conrad, Manager Office: 227-5330 Mobile Service: 442-7207 Home: 227-3539	Prickly Pear Creek

INDUSTRIAL WATER USERS (Continued)

<u>NAME</u>	<u>SOURCE</u>
Phillips Petroleum Company, Great Falls J. P. Frellick, Manager Office: 453-4371	Missouri River
St. Regis Paper Company, Libby Robert F. Burdick, Environmental Engineer Office: 293-4141	Libby Creek
St. Regis Paper Company, Troy Robert F. Burdick, Environmental Engineer Office: 293-4141	Kootenai River
W. R. Grace and Company, Libby Robert L. Oliverio, Operations Manager Office: 293-4131 Home: 293-4939	Rainy Creek

FIGURE 3. INDUSTRIAL SURFACE WATER USERS



MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Oil and Gas Conservation Division
325 Fuller Avenue
Helena, Montana 59601 (state office)
Phone: 449-2611

Off-duty hours:

Donald Chisolm
Home: 442-5976

15 Poly Drive
Billings, Montana 59102 (district office)
Phone: 252-5109

Off-duty hours:

Herbert Hadley
Home: 252-2950

702 North Kendrick Avenue
Glendive, Montana 59330 (inspector)

Off-duty hours:

Joe Simonson
Home: same

218 Main Street
Shelby, Montana 59474 (district office)
Phone: 434-2422

Off-duty hours:

Claire Haughey
Home: 434-2960

Conservation Districts Division
Mitchell Building
Helena, Montana 59601
Phone: 449-2608

Off-duty hours:

Ole M. Ueland
Home: 792-6190

Agricultural surface water users will be contacted through this division. However, this does not preclude action by other parties when earliest possible notification is critical.

Active irrigation districts and private ditch companies or associations are listed in tables 4 and 5, respectively. Sub-major and minor river basin delineations are those given in the Montana Water Resources Board Atlas.

TABLE 4. ACTIVE IRRIGATION DISTRICTS IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>IRRIGATION DISTRICTS</u>
Kootenai	76 D (Tobacco River)	Glen Lake S. S. Frost, Secretary (406) 296-2804
Flathead	Ashley Creek	Ashley Lake Harry M. Isch (406) 756-6796
Flathead	76 L (Flathead River below Flathead Lake)	Mission W. Ray Jensen (406) 745-3410
		Flathead Robert E. Carson Secretary and Commissioner (406) 883-2391
		Jocko Valley Paul Wolf, Arlee 59821
Upper Clark Fork		Clinton Mrs. John Stitt (406) 825-3202
	76 P (Bitterroot River)	Bitterroot Jean Pfeifer (406) 363-1311
		Blodgett Creek Mrs. William Attinger Route 2 Hamilton, Montana 59840
		Canyon Creek Norman Sorenson (406) 363-1481
		Carlos Heights Delores Davis Route 1, Box 278 Hamilton, Montana 59840
		Lomo James Ruark (406) 363-2048
		Ward Mrs. Alta M. Porter (406) 363-3758

ACTIVE IRRIGATION DISTRICTS IN MONTANA

SUB-MAJOR RIVER BASIN

MINOR BASIN

IRRIGATION DISTRICTS

Mill Creek
Mrs. Marie Kaphammer
(406) 961-3364

Sunset
J. E. Wallace
(406) 777-3356

Lower Clark Fork

76 M (Clark Fork)

Big Flat
Mrs. Kenneth C. Hayes,
Secretary
(406) 549-4376

Missoula
Raymond P. Tipp
(406) 549-5186

Frenchtown
Armand J. Lucier
(406) 549-4950

Missouri-Smith

41 I (Missouri
River)

Toston Irrigation District
Sam Kirksey,
Secretary-Treasurer
(406) 266-4278

Helena Valley
Robert Green, Mgr.
(406) 442-9040
Ext. 3291

Missouri-Sun-Marias

41 O (Teton River)

Bynum
Ira E. Perkins, Sec.
Bynum Irrigation
District
Bynum, Montana 59419

41 K (Sun River)

Greenfields
Ole I. Vervick
(406) 467-2626

41 K (Sun River)

Fort Shaw
Herbert A. Sharpe, Mgr.
Fort Shaw, Montana
59443

Milk

40 J (Milk River
between Fresno
Reservoir and White-
water Creek)

Alfalfa Valley
J. L. Gesell
(406) 357-2719

ACTIVE IRRIGATION DISTRICTS IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>IRRIGATION DISTRICTS</u>
Milk	40 J (Milk River between Fresno Reservoir and White- water Creek)	Fort Belknap Mrs. Monica D. Miller (406) 357-3230
		Paradise Valley Lynn Minnick
		Zurich J. R. Inmann (406) 357-2590
		Harlem (Sherborne Lake) Thomas E. Delvin (406) 353-2438
		Dodson Harry Benzinger (406) 654-1639
		Malta Harry Benzinger (406) 654-1639
	40 O (Milk River below Whitewater Creek)	Glasgow Harry Benzinger (406) 654-1639
Upper Yellowstone	43 B (Yellowstone River above Bridger Creek)	Big Timber Creek Canal Co. Sid J. Huyser (406) 932-2750
	43 QJ (Yellowstone River from Bridger Creek to Clarks Fork of Yellowstone)	Danford R. Merrit Williams (406) 698-6627
Middle Yellowstone	43 Q (Yellowstone River between Clarks Fork and Big Horn River)	Victory John A. Forsythe (406) 252-3479
		Lockwood Joe Seiffert (406) 259-9234
		Huntley Victor H. Kruzik (406) 967-3400

ACTIVE IRRIGATION DISTRICTS IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>IRRIGATION DISTRICTS</u>
Middle Yellowstone	43 Q (Little Big Horn River)	Upper Little Horn c/o Robert S. Kennedy Drawer A Lodge Grass, MT 59050
		Lower Little Horn and Lodge Grass Bert W. Kronmiller (406) 665-1902
	43 P (Big Horn River)	Big Horn C. L. Egnew (406) 665-1802
	42 KJ (Yellowstone River between Big Horn River and Tongue River)	Yellowstone Mrs. Laura Goodale (406) 343-2296
		Cartersville R. C. Harken (406) 356-7616
		Hammond R. C. Harken (406) 356-7616
Lower Yellowstone	42 K (Yellowstone River between Tongue River and Powder River)	Tongue and Yellowstone River Emmett Gardner (406) 673-5404
		Intake Mrs. Thelma Barber (406) 482-2286
		Lower Yellowstone- District 1 Victor Norlin (406) 482-1766
		Savage Mrs. Thelma Barber (406) 482-2286

TABLE 5. PRIVATE DITCH COMPANY OR ASSOCIATION
IN MONTANA

SUB-MAJOR RIVER BASIN	MINOR BASIN	PRIVATE COMPANY OR ASSN.
Upper Clark Fork	76 F (Blackfoot River)	Nevada Creek Water Users Association Mrs. Janet Manley (406) 288-3414
	76 G (Clark Fork above Blackfoot River)	West Side Ditch Co. J. B. Kendrick (406) 846-2316
	76 GJ (Flint Creek)	Flint Creek Water Users Assn. Frank Waldbillig, Jr. (406) 859-3282
Upper Clark Fork	76 H (Bitterrot River)	Carlton Creek Irrigation Co. Charles Schmitz (406) 273-6792
		Sweeney Creek Water Users Association R. Keith Osterheld (406) 777-3269
		Bass Lake Reservoir Co. George Ruffatto (406) 777-3340
		Etna Ditch Company W. A. Groff (406) 642-3455
		Supply Ditch Assn. (including Wood-Parkhurst) Robert J. Thomas (406) 777-5712
		Union Ditch Company Wayne L. Dayton (406) 777-3467
		Webfoot Ditch Company John G. Weigand (406) 777-3195
		Big Creek Lakes Reservoir Assn. Dick Langton (406) 642-3294
		Fred Burr Creek Water Users Assn. Arnold H. Raudsep (406) 961-3694

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Clark Fork

MINOR BASIN

76 H (Bitterroot
River)

PRIVATE COMPANY OR ASSN.

Corvallis Canal & Water
Company

Florence M. Eddy
Corvallis, MT 59828

Daly Ditches Project
Pete Leonardi
(406) 363-1497

Rock Creek Water Co.
Max Eldredge
(406) 363-3483

Tin Cup Water Company
George M. Steward
(406) 363-1222

Lower Clark Fork

76 L (Flathead
River below
Flathead Lake)

Charlo Water Users Assn.
James J. Sivils
(406) 644-2676

76 M (Clark Fork
between Blackfoot
River and Flathead
River)

Grass Valley-French
Ditch Company
Louis A. Sol
(406) 549-4448

Hellgate Valley Irrigation
Company
Elmer Flynn
(406) 549-6252

Orchard Homes Ditch Co.
Mrs. R. A. Shannon
(406) 542-2399

Upper Missouri Tributaries

41 B (Beaverhead
River)

West Side Canal Company
H. B. Carlson
(406) 683-2434

Beaverhead Water Company
Richard Burns
(406) 683-2282

Canyon Irrigation Co.
(406) 683-2791

Dillon Canal
Glenna Yonce
(406) 683-2069

East Bench Irrigation
District
Carl M. Davis
(406) 683-2363

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>PRIVATE COMPANY OR ASSN.</u>
Upper Missouri Tributaries	41 C (Ruby River)	Indian Creek Ditch & Irrigating Company Frank E. Blair (406) 843-5431
		Ruby River Water Users Assn. James R. Mantz (406) 842-5562
		Vigilante Canal Users Assn. James R. Mantz (406) 842-5562
		West Bench Canal Users Assn. James R. Mantz (406) 842-5562
		Three Creeks Water Company Richard L. Todd (406) 842-5594
		Beaverhead Co-op Ditch Co. (Mutual) C. J. Cox (406) 684-5524
41 F (Madison River)		O'Dell Ditch (Mutual) Paul H. Love (406) 682-4296
		West Madison Canal Company James E. Robertson Ennis, Montana 59729
41 G (Jefferson River)		Baker Ditch Company (Mutual) C. J. Cox (406) 674-5524
		Pageville Canal Company Louise Balkovetz (406) 684-5542
		Creeklyn Ditch (Mutual) Alex T. Nelson (406) 287-3603
		Old Hale Ditch Company John F. Steingruber (406) 285-6911
		Cataract Water Users Assn. William T. Jackson (406) 685-2357

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>PRIVATE COMPANY OR ASSN.</u>
Upper Missouri Tributaries	41 G (Jefferson River)	Willow Creek Water Users Association Mrs. David W. Almendinger (406) 685-3305
		Fish Creek Irrigating Ditch Company (includes Pleasant Valley Ditch) Lucille A. Hubbard (406) 287-3362
		Jefferson Canal Company Betty Brown Whitehall, Montana 59759
		Pipestone Water Users Association Kenneth Sears (406) 287-3388
		Parrot Ditch Company Mrs. Edna Kibler (406) 287-3716
		Whitetail Water Users Assn. Robert A. Schraeder (406) 287-3678
		Whitetail Ditch Company L. T. Robbins (406) 287-3691
41 H (Gallatin River)		Farmers Canal Company Mrs. Garth Sime (406) 763-4573
		Baker Ditch Company H. D. Korslund (406) 586-5444
		Beck-Border Ditch (Mutual) D. M. Fulton (406) 587-7216
		High Line Canal Company H. D. Korslund (406) 586-5444
		Kughen Ditch Company Joe Alberda (406) 586-9381

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Missouri Tributaries

MINOR BASIN

41 H (Gallatin River)

PRIVATE COMPANY OR ASSN.

Lower Middle Creek Supply Ditch
(Mutual)
D. M. Pulton
(406) 587-7216

Low Line Canal Company
H. D. Korslund
(406) 587-5444

Middle Creek Ditch Company
Lloyd Raffety
(406) 587-3664

Middle Creek Water Users Assn.
Mrs. Bert L. Dusenberry, Jr.
(406) 586-5710

Mystic Lake Ditch Assn.
(Mutual)
Mrs. Alvin Goldenstein
(406) 586-6070

Warm Springs Canal Company
H. D. Korslund
(406) 586-5444

West Gallatin Canal Company
Sherman Smith
(406) 587-8917

Dry Creek Irrigation Company
Ralph Stucky
(406) 388-4526

Hoffman-Weaver Ditch Company
Bob Prescott
(406) 388-4551

Mammoth Ditch Company
S. A. Taylor
(406) 388-6331

Spain-Ferris Ditch Company
Tom E. Ross
(406) 388-6673

Lewis Ditch (Mutual)
John Venhuizen
(406) 284-6648

Perks Canal, Inc., (Mutual)
Allen Scollard
(406) 284-3761

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>PRIVATE COMPANY OR ASSN.</u>
Missouri-Smith	41 I (Missouri River above Holter Dam)	Broadwater-Missouri Water Users Association Mrs. Alberta Nave (406) 266-3447
		Montana Ditch Company J. G. Rains (406) 266-4217
	41 J (Smith River)	Smith River Water Users Assn. Emmett Cox (406) 547-3339
Missouri-Sun-Marias	41 U (Dearborn Rv.)	South Side Canal Users Assn. Emmett Cox (406) 547-3339
	41 K (Sun River)	Dearborn Canal & Water Company William J. Barrett (406) 562-3221
	41 L (Cut Bank Creek)	Nilan Water Users Assn. Victor Krueger (406) 562-3772
	41 P (Marias River)	Sun River Valley Ditch Company John Zeller (406) 965-3368
	41 O (Teton River)	Blackfeet Irrigation Project (includes Badger-Fisher and Two Medicine projects) Howard Johnson (406) 286-4566
		Brady Irrigation Association Dave Nelson (406) 753-2222
		Brady Water Users Association Mrs. Reba Donnell (406) 753-2266
		Pondera County Canal Reservoir Company Edward J. Garnett (406) 278-3359
		Eldorado Co-op Canal Company Robert Gronberg (406) 466-2964

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Missouri-Sun-Marias

MINOR BASIN

41 O (Teton River)

PRIVATE COMPANY OR ASSN.

Farmers Cooperative Canal Co.
R. W. Gronberg
(406) 446-2964

Teton Cooperative Canal Co.
Richard T. Arensmeyer
(406) 466-2738

Milk River

40 J (Milk River
between Fresno
Reservoir and
Whitewater Creek)

Havre Irrigation Company
H. L. Clack
(406) 265-4152

North Chinook Irrigation Assn.
Donald G. Snedecor
(406) 357-3397

Ft. Belknap Irrigation
Project
Superintendent
(406) 353-2263

Frenchman Water Users Assn.
Winston C. Howey
(406) 527-3275

Rock Creek Canal Company
Marion Hellestern
(406) 648-2128

Missouri-Musselshell

40 A (Musselshell
River above Roundup)

Lake Lebo Irrigation Company
George Glennie
(406) 632-4159

Upper Musselshell Water
Users Association
Clarence H. Dettmann
(406) 632-5667

Deadman's Basin Water Users
Association
Ronald Belcher
(406) 636-4721

Lavina Water Users Assn.
(Mutual) Deadman Basin Water
Users
Ronald Hansen
(406) 636-2285

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

<u>SUB-MAJOR RIVER BASIN</u>	<u>MINOR BASIN</u>	<u>PRIVATE COMPANY OR ASSN.</u>
	40 B (Flatwillow Creek including Box Elder Creek)	Petrolia Water Users Association James C. McQue (406) 429-3125
		Yellowwater Water Users Association Floyd R. Hill (406) 429-3425
		Winnett Irrigation Company Leonard Eld (406) 538-5101
	40 C (Musselshell River below Roundup)	Delphia-Melstone Canal Users Association E. Keith Stensvad (406) 358-3442
Missouri-Fort Peck	41 S (Judith River)	Ackley Lake Water Users Association Steward J. Thomas (406) 423-5515
	40 E (Missouri River between Musselshell and Ft. Peck Dam)	Wiota Pump Unit (Ft. Peck Project) Laurence Wiseman (406) 695-4408
	40 S (Missouri River below Fort Peck Dam)	Frazer-Wolf Point Unit (includes Little Porcupine Division and Ft. Peck Project) Walter E. Johnson (406) 653-2228
Upper Yellowstone	43 A (Shields River)	The Shields River Branch Edwin W. Jordan Wilsall, Montana 59086
		Upper Cottonwood Ditch Co. (Mutual) Arthur Keyes (406) 578-2251
		Lower Shields River Canal Co. Leon H. Sarrazin (406) 686-4636
		Shields Canal Company Mrs. Carl Arthur (406) 578-2206

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Yellowstone

MINOR BASIN

43 B (Yellowstone
River above
Bridger Creek)

PRIVATE COMPANY OR ASSN.

Livingston Ditch Water Users Assn.
Kenneth Lovely
(406) 222-3161

Paradise Water Users Assn.
Tom Durgan
(406) 222-2789

Park Branch Water Users Assn.
Tom Durgan
(406) 222-2789

Big Timber Creek Canal Co.
Mrs. Harry Boeh
(406) 932-2156

Company (or Boggs) Mutual
Ditch
Miller Pederson

Conwell Mutual Ditch
E. O. Overland
(406) 932-2106

Dry Creek Canal Company
E. J. Roberts
(406) 932-2766

Ellison Mutual Ditch Co.
Dudley S. Tyler
(406) 932-2612

Hunter's Hot Spring Canal Co.
Dallas A. Roots
(406) 932-2899

Pioneer Ditch Company
Teddy Thompson
(406) 932-2551

43 D (Clarks Fork of the Yellowstone) Rocky Point Ditch Company
Mrs. Dale Grebe
(406) 664-2455

Wills Canal Company
Ed Fabrizius
(406) 664-2637

Youst Ditch Company
Mrs. Bertha Andrew
(406) 664-2994

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Yellowstone

MINOR BASIN

43 D (Clarks Fork
of the Yellow-
stone)

PRIVATE COMPANY OR ASSN.

Bridge Ditch Company
Gerald Koch
(406) 662-3314

Dry Creek Canal &
Irrigation Company
Stasia Gurrells
(406) 662-3615

Golden Ditch Company
Stasia Gurrells
(406) 662-3615

Holland Ditch Company
Mrs. Jerome Lantz
Bridger, MT 59014

Sand Creek Canal Co.
(including Fromberg,
Lincoln, and Lynne
Ditches)
Gerald Koch
(406) 662-3314

Mutual Ditch Company
Walter Skorupa
(406) 662-3743

Bartlett Canal Company
Otto Yedlicka
(406) 668-7371

Carbon Canal Company
(extension of the Last
Chance Ditch)
John Ross
(406) 668-7396

Orchard Canal Company
John Ross
(406) 668-7396

Edgar Canal Company
Letha Humiston
(406) 962-3294

Elbow Ditch Company
Mike Gross
(406) 962-3210

Post-Kellog Mutual
Grant Duncan
(406) 932-2649

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Yellowstone

MINOR BASIN

43 D (Clarks Fork
of the Yellowstone)

PRIVATE COMPANY OR ASSN.

Prather-Mayborn-Westfall Mutual
Ditch
Orlando Terland
(406) 932-2969

Sweetgrass Canal & Reservoir
Company
Dallas A. Roots
(406) 932-2899

43 BJ (Boulder
River)

McLeod Mutual Ditch
Clark Engle
(406) 932-2789

43 C (Stillwater
River)

Mendenhall Ditch Co., Inc.
Ingwald Johnson
(406) 328-3150

West Fork Irrigation Co.
Vernon Zook
(406) 446-1192

Inter-state Irrigating &
Mining Company
E. W. Hergett
Belfry, Montana 59008

Riverview Ditch Co.
Mrs. Dale Grebe
(406) 664-2455

43 D (Clarks Fork
of the Yellowstone
River)

Weast Irrigation Ditch, Inc.
W. A. Niemi
(406) 446-2849

Haara Ditch Company
Arthur Luoma
(406) 446-1044

Rock Creek & Clear Creek
Ditch Company
H. M. Rae
(406) 446-1132

Pryde Ditch Company
Alvin W. Draper
(406) 446-1042

Bailey Ditch Company
Arthur DeVries
(406) 445-2462

Clear Creek Ditch Company
Emitt Kober
(406) 446-1986

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Upper Yellowstone

MINOR BASIN

43 D (Clarks Fork
of the Yellowstone
River)

PRIVATE COMPANY OR ASSN.

Consolidated Ditch
Mrs. Eli Prinkki
(406) 446-1185

Finn Ditch Company
Leonard Bell
(406) 446-2186

Pleasant Valley Canal Co.
Joseph E. North
(406) 446-1805

Last Chance Ditch, Inc.
Helen Weatherford
R. R. 1, Box 136
Joliet, MT 59041

New First Chance Ditch Co.
Judith M. Cole
(406) 962-3371

New Granite Ditch Co.
Mrs. Vernon Williams
(406) 962-3473

New Prosperity Ditch Co.
Adam Stief
(406) 962-3315

Big Four Ditch Company
Adam Krug
Silesia, MT 59080

White Horse Canal Co.
Albert Yager
(406) 698-4018

43 QJ (Yellowstone
River from Bridger
Creek to Clarks
Fork of the Yellow-
stone)

Kent Mutual Ditch
Mrs. Viola Pollard
(406) 932-2247

Yellowstone Ditch Company
Tom Kober
(406) 633-2260

Columbus Water Users Assn.
Robert C. Graham
(406) 322-5333

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SJB-MAJOR RIVER BASIN

Middle Yellowstone

MINOR BASIN

43 O (Little
Big Horn River)

PRIVATE COMPANY OR ASSN.

Bozeman Trail Ditch Company
Alex Nayas
(406) 343-2482

43 P (Big Horn
River)

Big Horn Low Line Ditch Co.
John Dudis
(406) 665-2717

43 Q (Yellow-
stone between
Clarks Fork and
Big Horn River)

Two Leggins Water Users Assn.
Bert Krommiller
(406) 665-1902

Big Ditch Company
Louis Crow
(406) 698-6517

Cove Irrigation Company
Louis Crow
(406) 698-6517

High Line Ditch Company
Louis Crow
(406) 698-6517

Italian Ditch Company
J. O. Wold, Jr.
(406) 698-6481

Old Mill Ditch Company
Louis Crow
(406) 698-6517

Snow Ditch Company
Louis Crow
(406) 698-6517

Canyon Creek Ditch Co.
Paul O. Nilson
(406) 259-3274

Clarks Fork Ditch Co.
Marvin Onstad
(406) 252-4944

Coulson Water Users Assn.
Lew Lehman
(406) 373-5590

Farmers Ditch Company
Rex Hibbs, Secretary
(406) 252-4101

PRIVATE DITCH COMPANY OR ASSOCIATION IN MONTANA

SUB-MAJOR RIVER BASIN

Middle Yellowstone

MINOR BASIN

43 Q (Yellowstone between Clarks Fork and Big Horn River)

PRIVATE COMPANY OR ASSN.

Joliet Irrigation Company
Helen Stamm
(406) 245-3212

Miller-McGill Ditch Co.
Oscar Heinle
(406) 373-5371

Suburban Ditch Company
Mrs. Lillian Morton
(406) 245-4046

Billings Bench Water Assn.
Jake DeVries
(406) 259-6241

42 C (Tongue River below Hanging Woman Creek)

Tongue River Water Users Association
Mrs. Joyce Brien
(406) 784-2590

42 KJ (Yellowstone River between Big Horn River and Tongue River)

Ranch Ditch Company
Ralph Swanson
(406) 342-2124

Box Elder Ditch Company
Ethel Kolb
(406) 342-2972

Hysham Water Users Assn.
Morris Moerkerke
(406) 342-2611

Hathaway Irrigation Assn.
John F. Baringer

Lower Yellowstone

42 K (Yellowstone River between Tongue River and Powder River)

Kinsey Irrigation Company
Fred Campbell
(406) 232-1908

Sidney Water Users Assn.
Gerald O. Butner
(406) 482-3520

MONTANA FISH AND GAME DEPARTMENT

Mitchell Building, Helena, Montana 59601

Wes Woodgerd Director	Office: (406) 449-3186 Home: (406) 443-2901
Fletcher Newby Deputy Director	Office: (406) 449-3187 Home: (406) 449-6512
James A. Posewitz Chief, Environmental Research	Office: (406) 449-2446 Home: (406) 442-3426
Arthur N. Whitney Chief, Fisheries	Office: (406) 449-2449 Home: (406) 443-2739

Route 3, Kalispell, Montana 59901

Thomas R. Hay	Office: (406) 756-4945 Home: (406) 752-2925
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Highway 93 So., Missoula, Montana 59801

James A. Ford	Office: (406) 549-1496 Home: (406) 728-4609
---------------	--

Route 3, Box 213, Bozeman, Montana 59715

LeRoy J. Ellig	Office: (406) 586-5419 Home: (406) 587-3930
----------------	--

Route 1 SW, Great Falls, Montana 59401

Nels A. Thoreson	Office: (406) 454-3441 Home: (406) 277-3288
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1125 Lake Elmo Drive, Billings, Montana 59101

Roger Fliger	Office: (406) 252-4654 Home: (406) 252-5924
--------------	--

Route 1-129, Glasgow, Montana 59230

Gene H. Sherman	Office: (406) 228-9347 Home: (406) 228-4755
-----------------	--

Box 430, Miles City, Montana 59301

Keith C. Seaburg	Office: (406) 232-4365 Home: (406) 232-2140
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DEPARTMENT OF HIGHWAYS

Civil Defense
1100 North Main
Helena, Montana 59601

Phone: (406) 449-3034

Off-duty hours:

John M. McClusky, Coordinator

Home: (406) 442-1113

Maintenance Division
Sixth Avenue and Roberts Street
Helena, Montana 59601

Phone: (406) 449-2676
(406) 449-2674

Off-duty hours:

Donald G. Gruel, Administrator

Home: (406) 442-0038

Francis W. Toombs,
Assistant Administrator

Home: (406) 443-3015

DIVISION OFFICES

Bozeman Division Office

Milner
Richard L. Smiller, Chief
Field Maintenance Bureau

Office: (406) 586-9562, 9192
Home: (406) 587-7097

Havre Division Office

Joseph W. Timmons, Chief
Field Maintenance Bureau

Office: (406) 265-6821, 2511
Home: (406) 265-6832

Wolf Point Division Office

Dean V. Borgen, Chief
Field Maintenance Bureau

Office: (406) 653-1050, 1051
Home:

Miles City Division Office

Dean V. Seiler, Chief
Field Maintenance Bureau

Office: (406) 232-1032, 1094
Home: (406) 232-2570

Lewistown Division Office

A. E. Harcharik, Chief
Field Maintenance Bureau

Office: (406) 538-8731, 8732
Home: (406) 538-3127

Missoula Division Office

William Blake, Chief
Field Maintenance Bureau

Office: (406) 549-6491, 6492,
6493
Home: (406) 728-1539

DEPARTMENT OF HIGHWAYS (Continued)

Butte Division Office

Robert J. Hinter, Chief
Field Maintenance Bureau

Office: (406) 494-3666, 3610, 2723
Home: (406) 792-3715

Great Falls Division Office

Raymond Wiley, Chief
Field Maintenance Bureau

Office: (406) 453-0591, 452-2361
Home: (406) 452-3616

Glendive Division Office

John D. Riley, Chief
Field Maintenance Bureau

Office: (406) 365-5296, 5297
Home:

Billings Division Office

William F. Woolston, Chief
Field Maintenance Bureau

Office: (406) 252-4138, 3682
Home: (406) 656-3908

Kalispell Division Office

William J. Hebert, Chief
Field Maintenance Bureau

Office: (406) 756-9033
Home: (406) 756-4219

MONTANA DEPARTMENT OF LAW ENFORCEMENT AND PUBLIC SAFETY

The Highway Patrol may be required when it is necessary to move equipment or a large number of vehicles. They may also be necessary for crowd control or any other emergency requiring their assistance.

Radio facilities are available at each county seat for contacting the sheriff or local law enforcement officers.

Motor Vehicles Division - Highway Patrol Bureau

Billings

424 Morey

Phone: (406) 245-6193
After hours: (406) 252-0588

Butte

Franklin and Lasalle

Phone: (406) 723-3914
After hours: (406) 723-4351

Glendive

West of Glendive

Phone: (406) 365-5238

Great Falls

104 18th Avenue N.E.

Phone: (406) 453-1121
If no answer: (406) 453-0368

Kalispell

Sixth Avenue N.E. and Montana

Phone: (406) 756-3639
Or: (406) 752-1497

Missoula

West Broadway

Phone: (406) 543-6368

Polson

Phone: (406) 883-2121

MONTANA DEPARTMENT OF AGRICULTURE

Pesticide Control Division
Mitchell Building
Helena, Montana 59601

Gary Gingery, Administrator

Office: (406) 449-3730
Home: (406) 458-5315

DEPARTMENT OF MILITARY AFFAIRS

Civil Defense
1100 North Main
Arsenal Building
Helena, Montana 59601 Phone: (406) 449-3034

Off-duty hours:

Phillip L. Kincheloe, Administrator Home: (406) 442-8936

George M. DeWolf
District 2 Coordinator Home: (406) 442-5512

PETROLEUM PRODUCTION AND PIPELINE COMPANIES

This list was prepared from the DIRECTORY FOR REPORTING OIL SPILLS IN MONTANA.

AMERADA DIVISION, AMERADA HESS CORPORATION
Box 1486, Williston, N.D. 58801

L. A. McLean

Office: (701) 572-3701
Home: (701) 572-5686

Orvall L. Schmidt

Office: (701) 572-3701
Home: (701) 572-7470

BIG WEST OIL COMPANY OF MONTANA
Kevin, Montana 59454

V. G. Minnich

Office: (406) 337-2301
Home: (406) 337-2371

Robert McKenzie

Office: (406) 337-2301
Home: (406) 337-2562

Box 3004, Minot, N.D. 58701

Forrest Baker

Office: (701) 838-9171
Home: (701) 839-1944

BUTTE PIPE LINE COMPANY

1700 Broadway, Denver, Colorado . 80202

M. C. Zwirbla

Office: (303) 222-8454 572-2451
Home: (303) 238-4088

~~D. E. Wooldridge W.C. Ezell~~

Office: (303) 222-8454 572-2452
Home: (303) 798-9820 (303) 770-5590

Box 396, Gle

687-2470

Office: (406) 687-2470 ~~778-3656~~
Home: (406) 365-1890

Drawer B Baker Montana 59313

C. E. Combrink

Office: (406) 778-3636
Home: (406) 778-3512

W.E. fiddle

Office: (406) 778-2626
Home: (406) 778-2166

C. Barclay

Office: (406) 778-2626
Home: (406) 778-3651

Box 317, Osage, Wyoming 82723

Office: (307) 465-2228
Home: (307) 746-2967 4323

Box 659, Torrington, Wyoming 82240

C. A. Niswonger
E. R. Tooley

Office: (307) 837-2350
Home: (307) 532-5600 2461

CARDINAL PETROLEUM COMPANY
Box 1077, Billings, Montana 59103

T. A. Voorhees

Office: (406) 248-7324
Home: (406) 656-5385

CENEX PIPELINE COMPANY
Box 8, Laurel, Montana 59044

U. S. Cowan

Office: (406) 252-0138
Home: (406) 245-4445

Tom E. Wilson

Office: (406) 252-0138
Home: (406) 656-6243

Fred E. Wentland

Office: (406) 252-0138
Home: (406) 259-7891

Hyman C. Maddox

Office: (406) 252-0138
Home: (406) 656-4205

Box 240, Glendive, Montana 59330

C. L. Landers

Office: (406) 365-2210
Home: (406) 365-3301

Box 523, Minot, North Dakota 58701

James H. Graves

Office: (701) 838-5615
Home: (701) 838-5872

CHEVRON OIL COMPANY
Box 599, Denver, Colorado 80201

W. B. Jackson

Office: (303) 292-1400
Home: (303) 781-6403

Box 146, Westby, Montana 59275

W. C. Punches

Office: (406) 385-4874
Home:

Box 2846, Great Falls, Montana 59401

E. C. Turnquist

Office: (406) 454-0035
Home: (406) 761-3284

R. B. Grant

Office: (406) 454-0035
Home: (406) 453-4149

L. D. Parrish

Office: (406) 454-0035
Home: (406) 452-2734

CONTINENTAL OIL COMPANY (Marketing)
Box 2548, Billings, Montana 59103

CONTINENTAL OIL COMPANY (Production and Drilling)
Box 43, Frannie, Wyoming 82423

205 Third Street West, Roundup, Montana 59072

152 North Durbin, Casper, Wyoming 82601

J. W. Wolfe, Jr. Office: (307) 234-7311
Home: (307) 237-9998

CONTINENTAL OIL COMPANY (Refinery)
Box 2548, Billings, Montana 59103

CONTINENTAL PIPE LINE COMPANY
338 Highway 87 East, Billings, Montana 59101

Robert Nivens Office: (406) 252-3841
Home: (406) 656-5838

404 North 31 Street, Billings, Montana 59101

Box 1252, Cut Bank, Montana 59427

Roundup, Montana 59072

900W 6500S, Woods Cross, Utah 84087

C. J. Hanan	Office: (801) 295-2325 Home: (801) 292-0845
Bernie Tuss	Office: (801) 295-2325 Home: (801) 292-2546

FARMERS UNION CENTRAL EXCHANGE, INC.
Box 126, Laurel, Montana 59044

Harold Williams	Office: (406) 698-4311 Home: (406) 698-4395
Louis Day	Office: (406) 698-4311 Home: (406) 698-4734
Roger Briggs	Office: (406) 698-4311 Home: (406) 698-4876
Harry Perrigo	Office: (406) 698-4311 Home: (406) 698-6876
John Warren	Office: (406) 245-3151 Home: (406) 656-2259
Richard Bell	Office: (406) 245-3151 Home: (406) 656-5155

FLINT ENGINEERING & CONSTRUCTION CO.
324 Petroleum Building, Billings, Montana 59101

C. C. Rowland	Office: (406) 245-3086 Home: (406) 252-7366
W. C. Fincher	Office: (406) 245-4179 Home: (406) 656-5349
H. W. Elledge	Office: (406) 245-4179 Home: (406) 259-7594

GULF OIL CORPORATION
Box 1971, Casper, Wyoming 82601

C. H. Phillips	Office: (307) 235-5783 Home: (307) 234-6610
M. R. Bearly	Office: (307) 235-5783 Home: (307) 265-2659
J. D. Mackay	Office: (307) 235-5783 Home: (307) 237-3908

HUMBLE OIL & REFINING COMPANY (Product)
Box 2514, Billings, Montana 59103

HUMBLE OIL & REFINING COMPANY (Crude Oil Production)
Box 120, Denver, Colorado 80201

HUMBLE OIL & REFINING COMPANY (Refinery)
Box 1163, Billings, Montana 59103

B. D. Nolan Office: (406) 252-3811
Home: (406) 252-6740

P. H. Long Office: (406) 252-3811
Home: (406) 556-3346

HUMBLE PIPELINE COMPANY
Box U, Bridger, Montana 59014

Box 2220, Houston, Texas 77001

Office: (713) 331-5442 (24 hours)

HUSKY OIL COMPANY
326 Transwestern Life Building Billings, Montana 59101

John A. Mercer Office: (406) 252-6382
Home: (406) 656-5532

(Contact for Montana EXCEPT Missoula-Kalispell area)

South 2123 Balfour Boulevard Spokane Washington 99203

(Contact for Montana, Missoula-Kalispell area)

MOBIL OIL CORPORATION
Box 2189, Fargo, North Dakota 58102

MURPHY OIL CORPORATION
Box 547, Poplar, Montana 59255

M. T. James	Office: (406) 768-3612 Home: (406) 768-3825
L. C. Loegering	Office: (406) 768-3612 Home: (406) 768-3872
Floyd O'Brien	Office: (406) 768-3612 Home: (406) 768-3859
William Brown	Office: (406) 768-3612 Home: (406) 768-3393

Murphy Building, El Dorado, Arkansas 71730

Ira Johnson	Office: (501) 862-6411 Home: (501) 862-2601
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PAN AMERICAN PETROLEUM CORPORATION
Box 739, Glendive, Montana 59330

L. A. McCrummen	Office: (406) 365-5271 Home: (406) 365-5323
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Box 569, Powell, Wyoming 82435

C. A. Ayling	Office: (307) 754-2281 Home: (307) 754-4730
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PHILLIPS PETROLEUM COMPANY
Box 938, Cut Bank, Montana 59427

R. E. Pratt	Office: (406) 938-4171 Home: (406) 938-4402
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G. E. Barrier	Office: (406) 938-4171 Home: 938-2180
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W. L. Wynn J. F. Zapp	Office: (406) 938-4171 Home: (406) 938-4660-938-2564
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Box 1145, Conrad, Montana 59425

J. C. Prewett R. E. Campbell	Office: (406) 278-5808 Home: (406) 278-3907-5888
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Box 187, Medicine Lake, Montana 59247

H. A. Nielsen C. E. Lane	Office: (406) 789-2201 2256
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SAMUEL GARY OIL PRODUCER
Box 99, Belle Creek, Montana 59317

300 Western Resources Bldg., Casper, Wyoming 82601

SHELL OIL COMPANY
1700 Broadway, Denver, Colorado 80202

Office: (303) 222-8454

SUN OIL COMPANY
Box 1798, Denver, Colorado 80201

W. J. Turner, Jr. Office: (303) 266-2181
Home: (303) 758-2686

TENNECO OIL COMPANY
Suite 1200 Lincoln Tower Building, Denver, Colorado 80203

J. E. Massey D. D. Meyers Office: (303) 292-9920
Home: (303) 841-3322 ~~770-4437~~

C. W. Nance J. L. Gaskill Office: (303) 292-9920
Home: (303) 985-5815 771-2934

TEXACO, INC. (Marketing)
220 North Alaska, Butte, Montana 59701

C. B. Barningham Office: (406) 792-1201
Home: (406) 723-5865

L. R. Cushing - Office: (406) 792-1201
Home: (406) 792-9925

TEXACO, INC. (Production)
202 East Second Street, Casper, Wyoming 82601

D. C. Baker Office: (307) 234-5353
Home: (307) 237-8318

TEXACO, INC (Producing Dept)
P.O. Box 2100, Denver, CO 80201

15. White (Asst Div Mgr)

THE TEXAS PIPE LINE COMPANY
Box 227, Cut Bank, Montana 59427

H. H. Beverly	Office: (406) 938-4312 Home: (406) 938-4244
J. W. Duncan	Office: (406) 938-4312 Home: (406) 938-4048
Mrs. Loretta Wynn	Office: (406) 938-4312 Home: (406) 938-4660

Glendive, Montana area

W. E. Taylor	Office: (406) 365-3005 Home: (406) 365-2796
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Kevin-Sunburst, Montana area

T. H. Potts	Home: (406) 937-3231
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UNION OIL COMPANY OF CALIFORNIA
Box 298, Cut Bank, Montana 59427

J. H. McCourt	Office: (406) 938-2271 Home: (406) 938-4065
A. C. Dyrdahl	Office: (406) 938-2271 Home: (406) 938-2544
L. Ellingson	Office: (406) 938-2271 Home: (406) 938-2662

UNION TEXAS PETROLEUM
Box 560, Glendive, Montana 59330

Kenneth C. Woodard	Office: (406) 486-2774 Home: (406) 486-2779
Samuel T. Wilkes	Office: (406) 486-2774 Home:

YELLOWSTONE PIPE LINE COMPANY
Box 185 Parkwater Station, Spokane, Washington 99211

Ronald E. Thompson	Office: (509) 534-0686 Home: (509) 924-5287
Marion P. Mowder	Office: (509) 534-0686 Home: (509) 924-3588
Ross Brown	Office: (509) 534-0686 Home: (509) 926-8514

338 Highway 87 East, Billings, Montana 59101

Central Dispatching Group	Office: (406) 252-0141
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Box 613, Billings, Montana 59103

John Roach Office: (406) 259-0405
Home: (406) 656-4561

318 Griffin Drive, Bozeman, Montana 59715

Canyon Ferry Route, Helena, Montana 59601

Perry Infield Office: (406) 442-5010-
Home: (406) 443-2988

Box 1251, Great Falls, Montana 59401

Route 2, Raser Drive, Missoula, Montana 59801

LIQUID AND BULK HAULERS

BELLE CREEK

Paraffin Service, Inc. (water - mud - oil) (406) 427-5797

BILLINGS

Greenup Trucking Co. (petroleum)	(406) 656-1403
Houck Transport Co.	(406) 259-5124
Johnson, H. F., Inc. (petroleum)	(406) 245-4153
Marcenko Trucking (dry bulk)	(406) 252-3985
Parish Truck Lines	(406) 259-1945
Rice Truck Lines	(406) 259-2573

BOZEMAN

Johnson, H. F., Inc. (petroleum)	(406) 587-7741
Rice Truck Lines	(406) 586-2284

BUTTE

Homer Earhart & Sons Trucking (bulk)	(406) 792-0563
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CUT BANK

Johnson, H. F., Inc. (petroleum)	(406) 938-4711
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DILLON

Frances Mooney Trucking	(406) 683-2131
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GLASGOW

Archambeault, Jim & Sons Trucking	(406) 228-8551
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GLENDIVE

Houck Transport Co.	(406) 365-5226
Keller Transport, Inc. (petroleum)	(406) 365-3825
Northern Tank Line (petroleum)	(406) 365-3358
Paraffin Services, Inc. (water - mud - oil)	(406) 365-4514 or (406) 365-2698

GREAT FALLS

Alaska Truck Transport, Inc.	(406) 453-7606
Benjamin, Donald L.	(406) 761-2027
Builders Transports, Inc. (dry bulk)	(800) 332-5967
Consolidated Freightways	(406) 453-1449
Great Plains Farmer Marketing Cooperative	(406) 453-3571
Herrett Trucking Co.	(406) 454-1916
Johnson, H. F., Inc. (petroleum)	(406) 454-1901
Northern Tank Line (petroleum)	(406) 453-3482
Rice Truck Lines	(406) 454-3496

HAVRE

Union Tractor Co., Inc. (406) 265-4715

HELENA

Northern Tank Lines (petroleum) (406) 442-2670

KALISPELL

Houck Transport Co. (406) 756-7987
Tompkins, Clyde (406) 756-9705

LAUREL

Consolidated Freightways (406) 698-4554
Northern Tank Line (406) 252-7576

MALTA

Matthews, Dewain Trucking (dry bulk) (406) 654-1663

MILES CITY

Northern Tank Line (petroleum) (406) 232-3150

MISSOULA

Johnson, H. F., Inc. (petroleum) (406) 549-3317
Western Transport, Grant Creek (406) 543-8651

PLENTYWOOD

Williston Scobey Transfer, Inc. (406) 765-1883

POPLAR

Rice Truck Line (406) 768-3642

SANTA RITA

Lahr, Rex Trucking (406) 938-2550 or
(406) 938-2644

SHELBY

Greenup Trucking Co. (406) 434-2023
Irvin, Dick (dry bulk) (406) 434-5583

SIDNEY

Hi-Line Trucking, Inc. (406) 482-1624

RAILROAD COMPANIES

Burlington Northern, Regional Offices, Billings	(406) 259-4521
Burlington Northern, Division Superintendent, Great Falls	(406) 761-0250
The Milwaukee Road, District Manager, Billings	(406) 245-3007
The Milwaukee Road, District Manager, Great Falls	(406) 452-6433
Union Pacific Railroad, Butte	(406) 792-2389

MONTANA OIL SPILL CLEAN-UP COOPERATIVES

Montana-Wyoming Control Coordination Committee

Continental Pipeline Company
404 North 31 Street
Billings, Montana 59101
(Leonard Jones, Chairman)

(406) 252-3841

PARTICIPATING FIRMS:

Cenex Pipe Line Company, Laurel
Continental Oil Company, Billings
Farmers Union Central Exchange, Laurel
Humble Oil and Refinery, Billings
Humble Pipe Line Company, Odessa, Texas
Husky Oil Company, Denver, Colorado
Marathon Pipe Line, Casper, Wyoming
Platte Pipeline Company, Powell, Wyoming
Yellowstone Pipe Line Company, Spokane, Washington

APPENDIX B
RESOURCES

The Associated General Contractors' Association (AGC) has developed "Plan Bulldozer" to deal with emergencies in Montana. "Plan Bulldozer," however, is not kept current because contractors' equipment is continually on the move. The AGC will put the plan together by telephone in the event of a disaster (AGC, 1972).

Associated General Contractors' Association, Inc.
J. W. Marlow, Secretary-Manager

(406) 442-4162

Division offices of the Montana Department of Highways may be contacted concerning available equipment in their areas. They can also furnish assistance in reaching a spill site.

The Montana-Wyoming Oil Control Coordinating Committee maintains a trailer equipped with rigid and sorbent booms, pipe for culverts, sorbent material, a skimmer and other tools and equipment. This equipment is also available to government agencies needing assistance.

TRANSPORTATION

Aircraft

BAKER

Bethel Aviation Service (406) 778-2627

BELGRADE

Flight Line, Inc. (406) 388-4274
Gallatin Flying Service, Inc. (406) 388-6733

BILLINGS

Combs Airways, Inc. (406) 245-6407
Commercial Helicopter, Inc. (406) 656-5020
Gillis Aviation (406) 252-6355
Lynch Flying Service, Inc. (406) 252-0508
Price Aviation (406) 248-8632

BOZEMAN

Central Helicopters, Inc. (406) 586-9185

BUTTE

Butte Aero Sales & Service, Inc. (406) 494-2455

CHINOOK

Hebbelman Flying Service (406) 357-4233 or
(406) 357-2282

CIRCLE

Commercial Helicopters, Inc. (406) 485-3529

CONRAD

Minuteman Aviation, Inc. (406) 278-3730
Pondera Flying Service (406) 278-3641

CUT BANK

Hamilton Flying Service (406) 938-4014
Kruger Helicopter Service (406) 938-2147

DILLON

Gaasch Flying Service (406) 683-2878

GLASGOW

Wokal Flying Service (406) 228-4023

GLENDIVE

Glendive Flying Service (406) 365-4756

GREAT FALLS

Holman Aviation Co. (406) 453-7613
Intermountain Helicopters (406) 452-9651
Montana Aerial Services (406) 453-1702
Northern Aviation Company (406) 453-3661
Skymart Aviation, Inc. (406) 761-4060

HAMILTON

Hamilton Aircraft (406) 363-3833

HAVRE

Hensley Flying Service (406) 265-9112 or
(406) 265-4452

HELENA

Morrison Flying Service (406) 442-2190

KALISPELL

Glacier View Skyways
Stockhill Aviations, Inc.
Strand Aviation

(406) 752-2390
(406) 756-9226
(406) 756-7678

LEWISTOWN

Central Air Service
Skycraft

(406) 538-3767
(406) 538-5457

LIVINGSTON

Michel's Flying Service

(406) 222-0932

MILES CITY

Falcon Aviation, Inc.
Miles City Aero Service

(406) 232-3375
(406) 232-1354

MISSOULA

Executive Aviation, Inc.
Johnson Flying Service, Inc.

(406) 543-8361
(406) 549-4158

POLSON

Timm Aero Service

(406) 883-4061

RED LODGE

Red Lodge Airways

(406) 446-2319

ROBERTS

Bangart Flying Service

(406) 445-2236

ROUNDUP

Albright's Flying, Inc.

(406) 323-1011

SHELBY

Shelby Flying Service

(406) 434-5672
After 5 p.m. (406) 434-2518

WEST YELLOWSTONE

Interwest Aviation of Montana, Inc.
Olympic Wing & Rotor, Inc.

(406) 646-7359
(406) 646-7312

Boats (small pleasure type craft only)

Montana Fish and Game Department
Helena, Montana

Also available locally from individuals owners and the National Guard.

Radio Equipped Vehicles

Montana National Guard
Helena, Montana

(406) 449-3660

Montana Department of Highways, Helena

Motor Pool Division

Refer to page 48 for division offices.

CONTAINMENT

Angle Iron

BILLINGS

Building Specialties, Inc.
Montana Steel & Supply Co.
Northland Steel Co.
Winter Hardware Co.

(406) 245-6464
(406) 252-2161
(406) 252-3826
(406) 252-2181

BOZEMAN

Midwest Welding & Machine Shop
Pacific Hide & Fur Depot
Weissman, Carl & Sons, Inc.

(406) 587-5417
(406) 586-6646
(406) 586-9200

BUTTE

Pacific Hide & Fur Depot
Western Iron Works, Inc.

(406) 792-0456
(406) 723-5471

GLASGOW

Pacific Hide & Fur Depot

(406) 228-2722

GLENDIVE

Glendive Machine Works
Trading Center

(406) 365-3590
(406) 365-5246

GREAT FALLS

Anderson Steel Supply Co.
Great Falls Iron Works

(406) 761-4354
(406) 452-8571

After 5 (406) 452-8879 or
(406) 452-4754

Northwest Steel, Inc.
Pacific Iron & Steel
Weissman, Carl & Sons, Inc.

(406) 452-9587
(406) 454-3435
(800) 332-5964

HAVRE

Pacific Hide & Fur Depot (406) 265-7141

HELENA

Caird Engineering Works (406) 442-7957
Pacific Hide & Fur Depot (406) 442-7851

KALISPELL

Montana Steel & Equipment (406) 756-9421
Pacific Hide & Fur Depot (406) 752-3494
Weissman, Carl & Sons, Inc. (406) 756-4671

LEWISTOWN

Pacific Hide & Fur Depot (406) 538-5245

MILES CITY

Pacific Hide & Fur Depot (406) 232-3583

MISSOULA

Montana Mercantile Co. (406) 543-5151
Pacific Hide & Fur Depot (406) 542-0381

PLENTYWOOD

Earl's Iron & Welding (406) 765-1373

SIDNEY

Pacific Hide & Fur Depot (406) 482-1301

WASHINGTON, SEATTLE

U. S. Steel Supply (206) MA3-3014

WASHINGTON, SPOKANE

Haskins Steel Co., Inc. (509) 535-2041
Ryerson, Joseph T. & Son, Inc. (509) KBS-1581
Stack Steel & Supply Co. ask operator for Enterprise 701

Booms and Skimmers

Montana suppliers for this equipment are not known. See Montana cleanup cooperatives.

Burlap Suppliers

Small quantities (less than 100 yards) are generally available from local upholstery shops. Larger quantities may be available from feed dealers and out-of-state suppliers.

Quantities and prices listed below are for December 1972.

BILLINGS

Martinson Custom Upholstery (406) 259-4083
(100 yards - could order more)

BOZEMAN

Bil-Mar Custom (406) 587-3356
(75 to 80 yards)

Cass Upholstery (406) 586-5119

Peavey Company (406) 586-2347
(sacks 5 cents each)

Quality Wholesale Company (406) 586-6310
(has several bolts)

HAVRE

Farmers Grain Exchange (406) 265-2275
(Their supplier is No-Dak Bag Co., Crystal, N.D.)

LAUREL

Peavey Company (406) 698-6324
(500 yards)

MALTA

Phil-Co Feeds (406) 654-1530

MILES CITY

Peavey Company (406) 232-2009
(1,000 sacks or more)

MISSOULA

Montana Feed and Grain (406) 543-7169
(burlap sacks 5 cents each)

PLENTYWOOD

Peavey Company (406) 765-1341
(has sacks - will order more)

SIDNEY

Peavey Company (406) 482-1304
(25,000 burlap sacks)

UTAH, SALT LAKE CITY

Silver State Suppliers
240 East on Second South - P. O. Box 895

Dirt and Gravel Hauling Trucks

ANACONDA

S & N Construction Company
East of Anaconda (406) 563-3031

BAKER

Baker Cement Products
Berwald Road (406) 778-3518

M & H Reddi-Mix & Construction
703 South Fourth West (406) 778-2043

BELGRADE

Pioneer Ready Mix Gravel Plant
Southeast of Belgrade (406) 388-6832

BILLINGS

Billings Sand & Gravel Co.
215 North 16th (406) 259-9967

Empire Sand & Gravel Co., Inc.
Mary Street (406) 252-8465 or
(406) 259-0551

H. C. L. Equipment, Inc. (406) 252-5154

Midland Materials Co.
748 S.W. 24 (406) 656-4210

O'Leary, Barry, Inc.
215 North 16th (406) 252-7139

BOZEMAN

Bozeman Sand & Gravel
19 East Griffin Drive (406) 586-2211

Gardner Construction
West Griffin Drive (406) 586-2245

Pioneer Ready Mix
North Seventh Avenue (406) 587-3118

BUTTE

Continental Concrete Co.
Continental Drive (406) 723-4667

Pioneer Concrete & Fuel Inc.
843 Maryland Avenue (406) 723-5435

CASCADE

Mortensen Construction Co. (406) 468-2301

COLUMBUS

Schessler Ready Mix Concrete, Inc. (406) 322-5660
South of Columbus

CONRAD

Korpela Trucking (406) 278-5563
Solid Road

Rocky Mountain Ready Mix (406) 278-5510
Northwest of Conrad

CUT BANK

Central Pre-Mix Inc. (406) 938-4110
East Railroad

Frenchy's Sand & Gravel (406) 938-4581
29 Fourth Avenue SW

Stordahl Excavation (406) 938-2020
218 North Central Avenue

DEER LODGE

Mastodon Sand & Gravel Co. (406) 846-2839
821 Missouri Avenue

DILLON

Robertson Ready Mix Concrete (406) 683-2101
North of Dillon

FORT BENTON

Tarbet Sand & Gravel (406) 622-5310
Northwest of Ft. Benton

FORT SHAW

Sun Sand & Gravel Co. (406) 264-2182

GARDINER

Brogan Sand & Gravel (406) 848-7200
Corwin Springs

GLASGOW

Fossum Ready Mix (406) 228-8038
GN Right-of-Way

GLASGOW

Glasgow Ready Mix Concrete Co., Inc.
Highway 2 East (406) 228-2458

GLENDIVE

Gene Wood Ready Mix
501 South Merrill Avenue (406) 365-2718

Knoll & Sons Ready-Mix
West Glendive (406) 365-2508

Western Gravel Supply Co.
West Glendive (406) 687-2655

GREAT FALLS

Concrete Service Co.
1000 11th Avenue North (406) 454-1375

Great Falls Redi-Mix Inc.
925 River Drive South (406) 453-2931
or (406) 761-5400

Johnson-Madison Lumber Co.
815 Ninth Street North (406) 453-3249

Montana Sand & Gravel
South of Great Falls (406) 761-4161

Nortensen Construction Co.
International Airport (406) 761-8374

Northern Materials
2100 Ninth Avenue North (406)-453-7201

HAMILTON

A B Concrete, Inc.
North of Hamilton (406) 363-3535

HARDIN

Raup, Chet, Ready Mix, Inc.
South of Hardin (406) 665-1000

HARLEM

Glasgow Ready Mix
122 First Avenue SW (406) 353-2422

HAVRE

Havre Sand & Gravel, Inc.
North of Havre (406) 265-6321

HAVRE

Papillo, Frank Construction
1221 Third Avenue North

(406) 265-2731

KALISPELL

Engebretson Gravel, Inc.
1200 East Oregon

(406) 756-4140

Kalispell Redi-Mix
Highway 2 East

(406) 752-2934

Kalispell Septic Tank Service

(406) 756-5880

McElroy & Wilken Ready Mix
Highway 2 East

(406) 756-3114

KEVIN

Frost Brothers

(406) 337-2171

LAUREL

Krug Brothers
South of Laurel

(406) 698-6807

O'Leary, Barry Concrete Plant
503 Railroad

(406) 698-6258

Schessler Ready Mix Concrete, Inc.
603 Railroad

(406) 698-4221

LEWISTOWN

McDonald Ready Mix Concrete
East of Lewistown

(406) 538-3463

LIBBY

Libby Transfer

(406) 293-4041

or (406) 293-4881

LIVINGSTON

Eggar Ready Mix Concrete Plant
9 St. Island

(406) 222-2170

MILES CITY

Doeden Construction Co.
Yellowstone Hill

(406) 232-1400

Miles City Sand & Gravel Co.
601 Wells

(406) 232-2404

MISSOULA

Associated Asphalt, Inc. 3800 - 26th	(406) 549-3593
Evans, J. B. Construction Grant Creek	(406) 549-3068
M & S Ready Mix Co. 3900 - 26th	(406) 543-8218
Pattee Canyon Gravel Sales Pattee Canyon Drive	(406) 549-9682
Ready-to-Pour Concrete Co. 1600 River Road	(406) 549-2385

POPLAR

Kelsey Ready Mix 151 Second Avenue West	(406) 768-3362
Kelsey, Warrin' Grain & Gravel Hauling Poplar	(406) 768-3383
Wolf Point Ready Mix East of Poplar	(406) 768-3932 or (406) 653-2122

SAND COULEE

Korin-Kovack Sand & Gravel Co.	(406) 736-5212
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SCOBAY

Jensen, Leonard Bud 504 First Avenue East	(406) 487-2420
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SHELBY

Shelby Sand & Gravel 123 Tenth Avenue North	(406) 434-5391
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SIDNEY

Sidney Red-E Mix, Inc. East of Sidney	(406) 482-1572
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SUN RIVER

Big Sky Sand & Gravel, Inc.	(406) 965-3313
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VAUGHN

Sun Sand & Gravel Co. West of Vaughn	(406) 965-3313
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WOLF POINT

Wolf Point Ready Mix Co.
Highway 2 East

(406) 653-2122

Piling, Telephone & Power Poles

BOZEMAN

Idaho Pole Co.

(406) 587-7456

CHRESTON

Creston Post & Pole Yard

(406) 884-3489

EVARO

J & N Posts & Poles

(406) 726-3548

HAMILTON

Porterbilt Post & Pole Co.

(406) 363-1456

KALISPELL

Kalispell Pole & Timber Co.

(406) 752-3421

LINCOLN

Blackfoot Treating Plant Post Yard
Bouma Post Yards

(406) 362-4250
(406) 362-4222

MISSOULA

City Electric
Western Forest Products, Inc.

(406) 549-4115
(406) 549-7901

PHILIPSBURG

Granite Timber & Treating Plant

(406) 859-3633

ROUNDUP

J. W. Sanner Lumber Co.

(406) 323-2679

STEVENSVILLE

Bass Creek Post & Pole Plant

(406) 777-3424

CLEANUP AND REMOVAL

Chemicals

WASHINGTON, SEATTLE

Van Waters & Rogers

(206) 682-3460

Pumping Supplies

ANACONDA

Marchion Hardware Co.
411 East Park Avenue

(406) 563-6911

BILLINGS

American Rent-All
2030 Fourth Avenue North

(406) 245-6663

Annin Engineering Sales
1925 Grand Avenue

(406) 252-5624

Barnard Clapper, Inc.
2102 Second Avenue North

(406) 252-9385

Bick, Hal W., Irrigation Systems
723 Dunham Avenue

(406) 259-6149

Big Horn Corp.
2223 Montana Avenue

(406) 252-4154

Billings Pipe and Pump Supply Co.
2424 Minnesota Avenue

(406) 245-6139

Continental Technical Services, Inc.
1402 Central Avenue

(406) 252-3232

Crane Supply Co.
24 South 30th

(406) 252-0579

Electric Motor Co.
1602 Fourth Avenue North

(406) 259-6710

Empire Steel Manufacturing Co.
501 North 18th Street

(406) 252-0101

Glacier Bit Service
2501 Arnold Lane

(406) 656-1816

Great Northern Tool & Supply Co.
2224 Minnesota Avenue

(406) 252-2175

Industrial Systems
405 16th West

(406) 252-6671

BILLINGS (continued)

Lee, Lloyd P. 2529 Rancho Road	(406) 656-5912
Master Plumbers Supply Northern Pacific Industrial Site	(406) 245-6603
Matlock Irrigation System 1002 Main	(406) 259-1712
Midland Implement Co. 402 Daniels	(406) 252-6681
Montana Machine Parts & Supply, Inc. 1200 Sixth Avenue North	(406) 245-6639
Montana Powder & Equipment Co. 1024 North Fourth Avenue	(406) 245-4426
O - M Equipment Co. 234 Moore Lane	(406) 259-8526
Parker Montana Co. 511 North 21	(406) 245-6627
Pneumatic Pump & Tool Repair 4228 Bruce Avenue	(406) 252-8810
Polar Pump & Irrigation Inc. 2021 Minnesota Avenue	(406) 245-6686
Watco Chemical 2102 Second Avenue North	(406) 259-2144
Weissman, Carl & Sons, Inc. 3425 First Avenue South	(406) 248-7464
Western Tractor Co. 2203 Montana Avenue	(406) 252-6639

BLACK EAGLE

Fleet Wholesale Supply 1101 Smelter Avenue	(406) 761-1451
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BOZEMAN

Jones Welding & Drilling Co. 2103 Bridger Drive	(406) 587-4002
Mountain Supply Co. 210 East Griffin Drive	(406) 586-2032
Owenhouse Hardware Co. 36 East Main	(406) 587-7735

BOZEMAN (continued)

Van Dyken, Bert Drilling Co.
403 West Villard (406) 586-2645

VanDyke-Halpin Irrigation Service, Inc.
West of Bozeman (406) 587-7904

BUTTE

Archibald Company
18 West Park (406) 723-8075

Barrus Drilling & Pump Co.
4 Mile Vue (406) 494-3349

Butte Machinery Co.
510 E. Aluminum (406) 723-6524

Farmers Union Trading Co.
624 East Front (406) 792-3904

Gardner-Denver Co.
215 East Park (406) 792-0449

LaVelle Powder Co.
South of Butte (406) 723-5938

Montana Hardware
823 South Montana (406) 723-6591

O'Keefe Drilling Co.
2804 Harvard Avenue (406) 792-3310

Perry, S. J. Company
712 South Arizona (406) 792-9148

CHOTEAU

Tesch Plumbing & Heating
22 First SW (406) 466-2041

CLANCY

Lindsay, W. J. Water Well Drilling (406) 933-5511

CONRAD

Al's Plumbing & Heating
17 Sixth Avenue S.E. (406) 278-5950

Bain's Plumbing & Heating
318 South Front (406) 278-3815

CONRAD

Farmers Supply Co-op
20 South Front (406) 278-5524

Yeager, James Irrigation Service
North of Conrad (406) 278-3348

CORVALLIS

Preston, Bill Well Drilling
East of Corvallis (406) 961-3482

CUT BANK

Cut Bank Building Service
East Railroad (406) 938-2293

Cut Bank Plumbing & Heating Co.
315 E. Railroad (406) 938-2422

DEER LODGE

Cook's Sales & Service
505 Main (406) 846-2504

DILLON

Briggs Drilling & Pump
1015 East Sebree (406) 683-5732

Hollensteiner, Carl F. Drilling
Hillcrest Acres (406) 683-2631

FAIRVIEW

Noyes Appliance Service
211 South Ellery Avenue (406) 747-5241

FORSYTH

Wallin Mercantile, Inc.
1145 Main (406) 356-7311

FORT BENTON

Water Systems, Inc.
1416 Main (406) 622-3336

GLASGOW

Dale Plumbing & Heating
306 First Avenue North (406) 228-8245

GLASGOW (continued)

Johnson, Elmer Plumbing & Heating
527 First Avenue South (406) 228-4932

GLENDIVE

Axelson, Inc.
306 North Kendrick (406) 365-3828

Crisafulli Pump Company, Inc.
West Glendive (406) 365-3393

Trading Center
West Glendive (406) 365-5246

GREAT FALLS

Empire Steel Manufacturing Company
807 Third NW (406) 452-3328

Graham & Ross
524 First Avenue South (406) 453-6591

Great Northern Tool & Supply
301 Second S (406) 453-6559

Keneco, Inc.
1827 Sixth NE (406) 454-1359

Killion-Moore, Inc.
116 Central Avenue West (406) 453-4363

Midland Implement Co., Inc.
312 Second South (406) 453-7618

Modern Equipment Co.
4025 Tenth Avenue South (406) 761-3230

Montana Plumbing Supply Co.
800 Second South (406) 453-3208

Ness Fire Fighting Equipment
1700 Third NW (406) 761-7821

Pinski Brothers Plumbing, Heating &
Refrigeration
1020 Central Avenue (406) 453-7644

Polar Pump & Irrigation Co., Inc.
325 Second South (406) 453-2441

Service, The
1112 Avenue D NW (406) 761-0404

GREAT FALLS (continued)

Smith Equipment Co.
820 Ninth North (406) 453-1141

Weissman, Carl & Sons, Inc.
300 Third Avenue South (406) 453-0301

HAMILTON

Bitterroot Cannery
315 North First (406) 363-1331

Bitterroot Plumbing, Heating & Appliances
210 North First (406) 363-1700

Valley Plumbing, Heating & Sheet Metal
177 South Second (406) 363-1844

HARDIN

Abell's Plumbing & Heating
19 West Third (406) 665-1404

Fox Oil Co.
7 North Center Avenue (406) 665-1007

Holmes Plumbing & Heating Co.
309 North Custer Avenue (406) 665-1604

HARLOWTON

Brown's Ranch Supply
911 Second NW (406) 632-4341

HAVRE

Fleet Wholesale Supply Co.
Highway 2 West (406) 265-7212

Hi-Line Drilling Service
1173 Sixth North (406) 265-4210

Nault Plumbing & Heating, Inc.
425 First (406) 265-9213

HELENA

Montana Powder & Equipment Co.
12 East Lawrence (406) 442-2990

Priced-Rite Discount Plumbing Supply
3710 North Montana Avenue (406) 442-3270

Rock Hand & Company Hardware
2414 North Montana Avenue (406) 442-7770

HELENA (Continued)

Warren Sales & Service, Inc.
Highway 12 East (406) 442-3899

Welch, A. F. Well Drilling
5820 North Montana Avenue (406) 458-5329

KALISPELL

Davis Pipe & Machinery Co.
29 North Main (406) 756-3318

Equity Supply Co.
150 First Avenue W. N. (406) 756-3651

Kersich Electric
234 Second Street W (406) 756-5292

McClarty Well Drilling
945 Eighth Avenue West (406) 756-4054

Weissman, Carl & Sons, Inc.
Meridian & Appleway (406) 756-9475

LEWISTOWN

Fleet Wholesale Supply
320 East Main (406) 538-5114

Rimby's Heating & Electric
504 First Avenue South (406) 538-9044

LIBBY

B & B Drilling Co.
West Highway 2 (406) 293-4029

C & L Plumbing & Heating, Inc.
On the Strip (406) 293-6279

Pival Electric Co.
301 California Avenue (406) 293-5356

LIVINGSTON

Western Plumbing & Heating, Inc.
425 South Second (406) 222-2073

MALTA

Jacobs Plumbing & OK Hardware
160 South First Avenue East (406) 654-1041

Simpson Drilling Co.
548 South Fifth East (406) 654-1831

MILES CITY

A & T Supply, Inc.	(406) 232-3422
2415 Main	
Doyle's Plumbing & Heating	(406) 232-0140
112 North Seventh	
Electric Motor Shop	(406) 232-3682
201 South Sixth	
Higgins Drilling Co.	(406) 232-2565
721 North Custer Avenue	

MISSOULA

Camp Well Drilling & Pump Supply Co.	(406) 549-3411
1522 South 14 West	
Hollibaugh's Pump Service	(406) 549-4779
444 South Avenue West	
Kartak's Pump Service	(406) 542-2980
1705 De Foe	
Mountain Supply Co.	(406) 543-8255
Mullan Road	
Star Rental	(406) 543-7138
2105 Stephens Avenue	

NASHUA

Miller's Construction Co.	(406) 746-4441
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RONAN - PABLO

Parker Irrigation Co.	(406) 676-3811
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SIDNEY

Harry's Plumbing & Heating	(406) 482-3105
607 Second S.E.	

SOMERS

Sliters'	(406) 857-3306
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TERRY

Reyman Hardware Co.	(406) 637-5440
200 Logan Avenue	

THREE FORKS

Bellach Plumbing, Heating & Electrical
209 South Main (406) 285-3217

VICTOR

Ravalli Pump & Supply (406) 642-3504

WHITEFISH

Ole's Plumbing & Heating
121 Central Avenue (406) 862-2811

WHITEHALL

General Sales & Service
209 West Legion (406) 287-9940

WOLF POINT

Simensen, K. A. Plumbing & Heating
502 Main (406) 653-1352

Swanson's Plumbing & Appliance
119 Anaconda (406) 653-1410

COLORADO, DENVER

Nash Engineering Co.
222 Milwaukee (303) 321-6830

WASHINGTON, SPOKANE

Harrington, Larry Co., Inc.
8005 North Country Homes Blvd. (509) 747-6138

Straw Supplies

The availability of straw depends on the wheat harvest, and so will vary from year to year. Grain and feed dealers should be contacted for the names of farmers with straw for sale.

The following list was compiled in December 1972.

BOZEMAN

Goldenstein, Alvin (406) 586-6070
Goldenstein, Gerald (406) 586-9771
Kraft, Kenneth (406) 587-7862

CUT BANK

Brownlee, Mack (406) 336-2111

GLASGOW

Hagen, Gerald (406) 367-4262

HELENA

Schatz, Frank (406) 442-7102

PLENTYWOOD

Peavey Company (406) 765-1341

RED LODGE

Hassa, Don (406) 446-1282

SIDNEY

Peavey Company (406) 482-1304

Liquid and Bulk Haulers

BELLE CREEK

Paraffin Service, Inc. (water - mud - oil) (406) 427-5797

BILLINGS

Greenup Trucking Co. (petroleum) (406) 656-1403

Houck Transport Co. (406) 259-5124

Johnson, H. F., Inc. (petroleum) (406) 245-4153

Marcenko Trucking (dry bulk) (406) 252-3985

Parish Truck Lines (406) 259-1945

Rice Truck Lines (406) 259-2573

BOZEMAN

Johnson, H. F., Inc. (petroleum) (406) 587-7741

Rice Truck Lines (406) 586-2284

BUTTE

Earhart, Homer & Sons Trucking (bulk) (406) 792-0563

CUT BANK

Johnson, H. F., Inc. (petroleum) (406) 938-4711

DILLON

Frances Mooney Trucking (406) 683-2131

GLASGOW

Archambeault, Jim & Sons Trucking (406) 228-8551

GLENDIVE

Houck Transport Co.	(406) 365-5226
Keller Transport, Inc. (petroleum)	(406) 365-3825
Northern Tank Line (petroleum)	(406) 365-3358
Paraffin Service, Inc. (water - mud - oil)	(406) 365-4514 or (406) 365-2698

GREAT FALLS

Alaska Truck Transport, Inc.	(406) 453-7606
Benjamin, Donald L.	(406) 761-2027
Builders Transport, Inc. (dry bulk)	(800) 332-5967
Consolidated Freightways	(406) 453-1449
Great Plains Farmer Marketing Cooperative	(406) 453-3571
Herrett Trucking Co.	(406) 454-1916
Johnson, H. F., Inc. (petroleum)	(406) 454-1901
Northern Tank Line (petroleum)	(406) 453-3482
Rice Truck Lines	(406) 454-3496

HAVRE

Union Tractor Co., Inc.	(406) 265-4715
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HELENA

Northern Tank Lines (petroleum)	(406) 442-2670
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KALISPELL

Houck Transport Co.	(406) 756-7987
Tompkins, Clyde	(406) 756-9705

LAUREL

Consolidated Freightways	(406) 698-4554
Northern Tank Line	(406) 252-7576

MALTA

Matthews, Dewain Trucking (dry bulk)	(406) 654-1663
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MILES CITY

Northern Tank Line (petroleum)	(406) 232-3150
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MISSOULA

Johnson, H. F., Inc. (petroleum)	(406) 549-3317
Western Transport, Grant Creek	(406) 543-8651

PLENTYWOOD

Williston Scobey Transfer, Inc.	(406) 765-1883
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POPLAR

Rice Truck Line (406) 768-3642

SANTA RITA

Lahr, Rex Trucking (406) 938-2550 or
(406) 938-2644

SHELBY

Greenup Trucking Co. (406) 434-2023
Irvin, Dick (dry bulk) (406) 434-5583

SIDNEY

Hi-Line Trucking, Inc. (406) 482-1624

Loaders

ALDER

Smail Construction Co. (406) 842-5213

ABSAROKEE

Oltrogge, Vic (406) 328-2376

ANACONDA

S & N Construction Co.
East of Anaconda (406) 563-3031

BAKER

Daniel Oil Field Construction, Inc.
123 North First West (406) 778-3521

M & H Reddi-Mix & Construction
703 South Fourth West (406) 778-2043

BIG TIMBER

Black Construction (406) 932-2150
Jarrett, Dave Construction (406) 932-2902
McKenzie Excavating & Ready Mix (406) 932-2406

BILLINGS

Demolition Service (406) 252-3346
305 South 25

Dudik Backhoe Service (406) 252-8451
1206 Main

BILLINGS (continued)

Ed's Plumbing & Heating 35 Florine Lane	(406) 252-1933
F E D Construction 245 Main	(406) 245-4734
G & B Excavation 1703 Cody Drive	(406) 245-3448
G & P Construction Co. 12033 Bench Blvd.	(406) 252-5396
Holm Sutherland Co. 29 Foster Lane	(406) 259-2583
Lockrem, Lloyd Construction, Inc. 123 South 23	(406) 248-8343
Lockwood Services, Inc. 1905 Sunrise Avenue	(406) 259-0130
Neibauer Construction Co. 1093 Calhoun Lane	(406) 259-8635
O'Leary, Barry, Inc. 215 North 16	(406) 252-7139
Rain Maker Sprinkling & Trenching Co., Inc. 515 Kuhlman Drive 2137 Wyoming Avenue	(406) 259-8180 (406) 656-6010
Reece Excavating & Construction Co. 926 Main	(406) 259-9729
Sanderson Sales, Inc. 105 Florine Lane	(406) 259-9494

BOZEMAN

Bob's Tilling & Digging Co. 412 East Olive	(406) 587-8324
Bozeman Blacktop Paving	(406) 586-2337
Budd Plumbing & Heating NW of Bozeman	(406) 586-5518
Cobe Enterprises, Inc. 514 North Montana	(406) 587-1813 If no answer, call Manhattan (406) 284-3381
Davis, Dan Construction Bear Canyon	(406) 587-1414
Figgins & Son Excavating 1404 Bohart Lane	(406) 586-6723 Mobile Service (406) 586-5650

BOZEMAN (continued)

Gardner Construction
West Griffin Drive (406) 586-2245

BUTTE

Brothers, Bill Excavating & Construction
3455 St. Ann (406) 792-7163

Dougdale Construction Co., Inc.
4 1/2 Mile Vue (406) 792-2435

Gilman, Jim Excavating, Inc.
Continental Drive (406) 723-6881 or
(406) 723-6349

CASCADE

Cobb, Clifford T.
308 First Avenue North (406) 468-2513

CHINOOK

Kleinjan, Marvin D.
1200 Ind. (406) 357-2406

Paulsen, Harold J.
South of Chinook (406) 357-2697

Pike, John
200 Missouri (406) 357-4125 or
(406) 357-2514

CHOTEAU

Swortzel, Robert
West of Choteau (406) 466-2886

COLUMBIA FALLS

B & F Excavating Co.
730 First Avenue West (406) 892-5152

CONRAD

Olson Brothers Excavating
219 South Montana (406) 278-5774

Prewett Construction (406) 278-5456 or
(406) 278-5824

CUT BANK

Abercrombie Construction Co., Inc.
East of Cut Bank (406) 938-2372
After hours (406) 938-5742

CUT BANK (continued)

Alme Construction Co. 338 North Central Avenue	(406) 938-4771
Cut Bank Plumbing & Heating Co. 315 East Railroad	(406) 938-2422
Frenchy's Sand & Gravel 29 Fourth Avenue SW	(406) 938-4581
H & N Construction East of Cut Bank	(406) 938-4095
Stordahl Excavation 218 North Central Avenue	(406) 938-2020

DEER LODGE

Armstead Construction 1115 Oregon	(406) 846-1913
Mastodon Sand & Gravel 821 Missouri Avenue	(406) 846-2839

DEVON

Benjamin Excavating	(406) 432-2196
Estermark Brothers Construction	(406) 432-2376

DILLON

Lumley, Chuck, Contractor North of Dillon	(406) 683-5826
Miller, R. E. & Sons Excavating 235 North Pacific	(406) 683-2175
Strasser Plumbing & Heating Co. 234 North Idaho	(406) 683-2692

EAST HELENA

Whitson Excavating	(406) 227-5531
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ENNIS

Saunders, Harrison	(406) 682-4854
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FAIRVIEW

Neu, W. L. Construction 517 South Dawson Avenue	(406) 747-5549
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GLASGOW

Fossum Ready Mix
GN Right-of-Way (406) 228-8038

Stuber, Allen J.
NE of Glasgow (406) 228-9023
If no answer call 228-4200

GLENDIVE

Anderson, L. P., Contractor, Inc.
West Glendive (406) 365-3321

Daniel Oil Field Construction, Inc.
East Allard (406) 365-5209

GREAT FALLS

Expert Excavating & Landscaping
722 Third Avenue South (406) 761-3769

Falls Construction Co.
1001 River Drive (406) 453-8715
If no answer call 453-2137

Kraus, James Construction
South of Great Falls (406) 452-1173

Newman Construction Co.
South of Great Falls (406) 452-9688

Pinski Brothers Plumbing, Heating &
Refrigeration
1020 Central Avenue (406) 453-7644

Tynes, Walter E. Co., Inc.
1324 13th Avenue SW (406) 454-3403

HARDIN

Kuntz Construction
4 South Miles Avenue (406) 665-2820

HAVRE

Baltrusch Construction Co.
West of Havre (406) 265-4329

Papillo, Frank Construction Co.
1221 Third Street North (406) 265-2731

HELENA

Anders Septic Tank Service (406) 442-9020

HELENA (continued)

Bezanson & Black	(406) 442-1555
MP Branning	(406) 442-1222
Capital Landscape & Excavating Unionville	(406) 442-4283
Helena Sand & Gravel	(406) 442-1185
Long, William F.	(406) 442-5843
Reynolds, Lee	(406) 442-4973

HYSHAM

Gibb, Stanley Ready-Mix & Construction	(406) 342-3211
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JORDAN

Curran & Rask	(406) 435-2893 or
	(406) 435-2894

KALISPELL

Green, Donald Land Clearing & Leveling 10 Meridian Road	(406) 756-5166
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Hall Ready Mix North End Seventh Avenue E. N.	(406) 756-5063
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Harp Line Constructors Co. Highway 2 East	(406) 756-7983
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Kalispell Septic Tank Service 176 East Cottonwood Drive	(406) 756-5880
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Linrude, Ray G. Construction Two Mile Drive	(406) 756-9150
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McElroy & Wilken Ready Mix 79 Seventh Avenue E. S.	(406) 756-5775
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KEVIN

Frost Fertilizer	(406) 337-2171
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LAUREL

Schessler Ready Mix Concrete, Inc. 603 Railroad	(406) 698-4221
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LEWISTOWN

Ycuderian, Fred Construction
139 13th Avenue South (406) 538-9592

LIBBY

C & L Plumbing & Heating, Inc.
On the Strip (406) 293-6279

Dick Parker Excavating
South Libby Hill (406) 293-4230

Libby Transfer
Ward Tracts (406) 293-4041

Schneider Brothers Construction
South Highway 2 If no answer call (406) 293-6309
(406) 293-4609 or
(406) 293-4508

Shranak, Henry
1203 Idaho Avenue (406) 293-5424

Warburton, Farrell C.
Mahoney Acres (406) 293-6015

LIVINGSTON

Egger Ready Mix Concrete Plant
9 St. Island (406) 222-2170

MELSTONE

Balock Excavating, Inc.
101 Fifth Avenue East (406) 358-2200

MILES CITY

Anderson, L. P. Contractor, Inc.
West of Miles City (406) 232-3920

Doeden Construction
Yellowstone Hill (406) 232-1400

Hardesty, Tom
302 North 12 (406) 232-3754

Pyle, Inc.
Becker Lane (406) 232-3349

MISSOULA

Billingsley Plumbing, Heating & Excavating
Mobile Service (406) 543-8157

MISSOULA

Crum Construction Co.
100 Russell (406) 543-3923

Jensen, Lawrence
1920 South Third West (406) 543-5268

Kallestad, H. G. Excavating
2624 Spurgin Road (406) 549-6269

O'Connor, Robert D.
2020 Peterson Avenue (406) 543-3878

Russell, Donald Excavating
3230 South Third West (406) 543-5751

Schmidt Construction Co.
Mullan Road (406) 549-5453

Simon, Dean I. Excavation
2519 Krysty Drive (406) 543-8703

Stratton, Gene C. Excavating
201 North Tower (406) 543-7338

Tabish, Lester D. Excavating
2219 42 (406) 543-3404

Tarbert, Ray
Grant Creek (406) 549-6751

Wagner, Harold H.
1620 Reserve (406) 543-8931

Washington Construction
500 Taylor (406) 728-2450

Willison, Glen L.
1220 Cooper (406) 549-2783

NOXON

Cluzen, Robert R. (406) 847-2452

RONAN - PABLO

Daniels Construction
3006 H (406) 676-2290

RUDYARD

May, John (406) 355-2183

SAND COULEE

Korin-Kovack Sand & Gravel Co.

(406) 736-5212

SCOBY

Jensen, Leonard Bud
504 First Avenue East

(406) 487-2420

SHELBY

Arrow Development Corp.
421 13th Avenue North

If no answer (406) 434-2792
(406) 434-5583

Westermark Brothers Construction

(406) 434-2981 or
(406) 434-2944

SHERIDAN

Smail Construction, Inc.
Alder

(406) 842-5213

SIDNEY

Ace Construction Co.

(406) 482-3883 or
(406) 482-3697

Harry's Plumbing & Heating
607 Second S.E.

(406) 482-3105

Jimison, Jim Excavating
Mobile Service

(406) 482-3751

Pederson, Friday Construction
114 Ninth Avenue NW

(406) 482-2657

T. W. Construction
819 Sixth Street SW

(406) 482-3891

STEVENVILLE

Weigand Construction
South of Stevensville

(406) 777-3197

THREE FORKS

Pierce Construction Co., Inc.
79 South Railroad Avenue

(406) 285-3522

TOWNSEND

George, Alex Excavating

(406) 266-4216

TROY

Marshall Wells Store

(406) 295-4524

TWIN BRIDGES

Braach, Jerry Construction
301 South Madison (406) 684-5551

VICTOR

Clark Brothers
NW of Victor (406) 642-3239

WESTBY

Meyer Brothers Construction (406) 385-3035
After hours call (406) 385-4532

WISDOM

McKevitt's Conoco Service (406) 689-2181

WOLF POINT

Grotte Construction
East Indiana (406) 653-1961

Hoch Excavating
Highway 2 East (406) 653-1114

Wolf Point Ready Mix Co.
Highway 2 East (406) 653-2122

WORDEN

Kierenfield, Clem (406) 967-2580

Schieffer Construction (406) 967-2000
If no answer call Billings (406) 248-8178

Vacuum Trucks

ALDER

Hansen's Service (406) 842-5533

BILLINGS

Billings Roto-Rooter Service (406) 252-5146

Gib's Sewer Service (406) 252-2302

Treasure State Plumbing & Heating Corp. (406) 259-2737
After hours call (406) 248-6322

BUTTE

Jim's Sanitary Service (406) 494-2862

CHOTEAU

Tesch Plumbing & Heating (406) 466-2041

CUT BANK

Cut Bank Plumbing & Heating (406) 938-2422

DEER LODGE

Hyer's Septic Tank Cleaning Service (406) 846-1437

GREAT FALLS

Cascade County Septic Tank Service (406) 761-4503

Peet, M. J. Septic Tank Service (406) 453-4234

Peet, Roscoe (406) 453-4234

HARDIN

Kirschenmann's Septic Tank Pumping (406) 665-2124 or
(406) 665-1841

HAVRE

Hill County Septic Tank Service (406) 265-6811

HELENA

Anders Septic Service (406) 442-9020

Interstate Enco Service Station (406) 442-1430

Reynolds, Lee Excavating Contractor (406) 442-4973

KALISPELL

Flathead Septic Tank Service (406) 756-3552

Kalispell Septic Tank Service (406) 756-5880

Pack & Co., Inc. (406) 756-3527

Wisher's Excavating & Landscaping (406) 756-4716

LIBBY

Parker, Dick Excavating (406) 293-4230

MANHATTAN

Septic Tank Service (406) 284-3325

MISSOULA

Missoula Septic Service	(406) 549-5640
POLSON	
Polson Pumping & Heating	(406) 883-2503
SIDNEY	
Harry's Plumbing & Heating	(406) 482-3105
TOWNSEND	
Septic Tank Service	(406) 284-3325
WOLF POINT	
Swanson's Plumbing and Appliance	(406) 653-1410

General Equipment

This list was compiled from telephone directory yellow pages and includes those contractors most likely to be called should a spill occur. Other contractors listed in the yellow pages but not listed here may also have equipment suitable for containment and cleanup of spills.

ALDER

Smail Construction Co.	(406) 842-5213 or
	(406) 842-5320

ANACONDA

S & N Construction	(406) 563-3031
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BELGRADE

M & M Ready Mix	(406) 388-6042
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BAKER

B & N Construction	(406) 788-2296
If no answer call	(406) 788-3657 or
	(406) 788-3677

Daniel Oil Field Construction, Inc.	(406) 778-3521
Night	(406) 778-3671

John's Oil Field Service	(406) 778-2291 or
	(406) 778-3884

M & H Reddi-Mix & Construction	(406) 778-2043
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Zion Construction	(406) 778-3710
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BIG TIMBER

McKenzie Excavating & Ready Mix (406) 932-2406

BILLINGS

Empire Sand & Gravel Co., Inc. (406) 252-8465

F B D Construction (406) 245-4734

Holm Sutherland Co. (406) 259-2583

Kiewit, Peter & Sons Co. (406) 656-1901

King Construction, Inc. (406) 252-8110

Neibauer Construction Co. (406) 259-8635

Reece Excavating & Construction (406) 259-9729

Wells Brothers Construction (406) 259-1018 or
(406) 259-6757

BOZEMAN

Bozeman Sand & Gravel (406) 586-2211

Cobe Building & Contracting Service (406) 587-1813 or
(406) 284-3381

Davis, Dan Construction (rental) (406) 587-1414

Edsall Construction (406) 587-0614

Haggerty-Messmer Co. (406) 586-5409

Howells, W. D. (406) 587-7034

BRIDGER

Albrecht & DeRudder Corp. (406) 662-3505

BROADUS

Williams & Sons, General Contractors (406) 436-2344
If no answer call (406) 436-2472

BUTTE

Bill Brothers Excavating & Construction (406) 792-7163

Gilman, Jim Excavating, Inc. (406) 723-6349

Miller, R. E. & Sons (406) 683-2175

Rite-way Asphalt Co. (406) 792-2404

CASCADE

Cobb, Clifford T. (406) 468-2513

CHESTER

Tiber Tractor Co. (406) 334-2921

CHOTEAU

Rainmaker Construction (406) 466-2058

CLYDE PARK

Bonnell's Garage (406) 686-4601

CULBERTSON

Larson Construction (406) 787-5825

S & S Construction (406) 787-5833

CUT BANK

Alme Construction Co. (406) 938-4771

Hav E Construction (406) 938-4321

Stordahl Excavation (406) 938-2020

DEVON

Benjamin Excavating (406) 432-2196

DILLON

Lumley, Chuck (406) 683-5826

DIXON

Elmo Road Corporation (406) 246-3568

EAST HELENA

Maronick Construction Co. (406) 227-5821

FAIRVIEW

Neu, W. E. Construction (406) 747-5549

GLASGOW

Stuber, Allen J. (406) 228-9023 or
(406) 228-4200

GLENDIVE

Rakes, George, Inc. (406) 365-3011
West Glendive

GREAT FALLS

Backhoe Service	(406) 452-0127
Montana Sand & Gravel	(406) 761-4161
Roberts Rocky Mountain Co. (rental)	(406) 761-6312
Volk Construction, Inc.	(406) 761-4260

HARDIN

Kuntz Construction	(406) 665-2820
Wimp's Electric Co.	(406) 665-2575

HELENA

Sharbano Construction Co.	(406) 442-8122
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HYSHAM

Gibb Stanley Ready-Mix & Construction	(406) 342-3211
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KALISPELL

Matelich, E. F. Construction Co.	(406) 756-7175
Montana Builders	(406) 756-6731
Tarbert, Ray Contractors	(406) 752-1058

KEVIN

Frost Brothers	(406) 337-2171 or (406) 337-2365
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LIBBY

C. & L. Plumbing & Heating	(406) 293-6279
Libby Transfer	(406) 293-4041 or (406) 293-4881
Parker, Dick Excavating	(406) 293-4230
Warburton, Farrel C.	(406) 293-6015

LIVINGSTON

Easton & Hiller Construction & Supply Co.	(406) 222-2220
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LOOKOUT PASS

Goodfellow Brothers, Inc.	(406) 678-4361
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MISSOULA

Hightower & Wallace Construction Co.	(406) 543-8321
Industrial Sales & Rentals	(406) 543-4496
Jensen, Lawrence	(406) 543-5268
Nicholson Paving Company	(406) 549-2871
	After hours (406) 543-7553 or
	(406) 728-2247
Schmidt Construction Co.	(406) 549-5453
Star Rental	(406) 543-7138
Tabish, Lester B.	(406) 543-3401
Tarbert, Ray Contractors	(406) 549-6751

NASHUA

Desonia Construction	(406) 746-4301
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PLENTYWOOD

Desonia Construction	(406) 765-2551
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ROUNDUP

C. Brewer, Inc.	(406) 323-2300
	After hours (406) 323-2416 or
	(406) 323-1326

SALTESE

Goodfellow Brothers, Inc.	(406) 678-4371
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SCOBAY

Jensen, Leonard	(406) 487-2420
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SIDNEY

Ace Construction	(406) 482-3893
If no answer call	(406) 482-3697

Gilford, R. H. Oilfield Construction	(406) 482-3794
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THREE FORKS

Sebena Construction	(406) 285-3454
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TRIDENT

Kiewit, Peter Son's Co.	(406) 285-3269
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TROY

Marshall Wells Store (406) 295-4524

TWIN BRIDGES

Branch, Jerry Construction Co. (406) 684-5551

WOLF POINT

Grottle Construction (406) 653-1961

Randolph & Son Construction Co. (406) 653-1021

Wolf Point Ready Mix Co. (406) 653-2122

WORDEN

Dierenfield, Clem (406) 967-2580

Schieffer Construction (406) 967-2000 or
(406) 248-8178

Portable Lighting Equipment

BILLINGS

Hole GM Diesel, Inc. (406) 252-4191

Yellowstone Electric Company (406) 252-3407

BUTTE

Farmers Union Trading Co. (406) 792-3404

GREAT FALLS

Normonth Equipment Co. (sales and rental) (406) 453-0091

HELENA

Honda of Helena (406) 442-5839

KALISPELL

Western Diesel Power, Inc. (406) 752-3589

LIBBY

Holeman GM Diesel, Inc. (406) 293-6635

MISSOULA

City Electric (sales and rental)
Western Diesel Power, Inc.

(406) 549-4115
(406) 728-3400

WISDOM

Larry's Automotive & Diesel Service

(406) 689-2594

MANPOWER AND EQUIPMENT (Field Operation Centers)

Equipment and men will be available only insofar as their normal workload will permit, and only to the extent that funds are made available from the requesting agency. Federal manpower and equipment may be obtained by contacting the Regional Headquarters of the federal department as listed in the subregion plan of each state.

APPENDIX C

SOME TREATMENT METHODS AND MATERIALS FOR OIL SPILLS

This chapter is intended to acquaint one with various methods used to contain and clean up oil spills. Specific materials and equipment are also discussed. The intent is to gain insight into the capabilities of specific materials and equipment, but not to endorse individual firms or products. Hopefully, this information will aid in selecting the most expeditious approach to cleanup.

BOOMS

Booms are physical containment devices which prevent oil from spreading across the water surface. They are anchored in place and depend on sufficient freeboard and skirting to prevent overtopping and passage of oil beneath the boom, respectively. No booms currently available are effective when current velocities exceed 1.2 feet per second, even with no wave action (Shell, 1972).

Slickbar Oil Boom (Slickbar, 1972)

The Slickbar Mark 6 is a multi-section oil boom using polyethylene flotation with a woven fabric skirt. Hardened lead for ballast is placed along the skirt bottom. An end view of a typical section is shown in Figure 5. A November 1972 price list is given in Table 6. Note that reported maximum permissible current velocities exceed 1.2 feet per second by 15 to 53 percent.

At present, the booms are manufactured upon receipt of special order in Westport, Connecticut. Three to four weeks is the estimated delivery time to Billings, Montana. This time will be shortened considerably when a stockpile is established along the Gulf Coast.

Grefco Sorbent Booms, Grefco, Inc., 1972)

Grefco Sorbent Booms are fiberfilled cylinders of about 10 feet by one foot and covered with a jute fabric. Dica-Sorb and Fiberperl, trade name sorbents, are the fiberfillings. Dica-Sorb will not sorb water according to the manufacturer.

Grefco products are used by several industries in Montana and distributor warehouses are maintained in Washington and Oregon. Montana firms, however, cannot be considered as regular supply sources. Therefore, the home office should be contacted for the nearest source of supply.

Grefco, Inc.
630 Shatto Place
Los Angeles, California 90005

(213) 381-5081

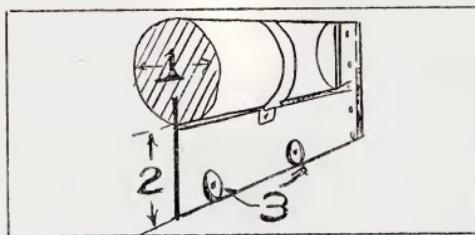


FIGURE 5. Slickbar Mark 6 Boom (1972)

TABLE 6. Slickbar Mark 6 Boom Price List (1972)

4" FLOAT		STANDARD SKIRT							
FIN DEPTH		6"		8"		10"		12"	
Max. Current Velocity Knots	weight lbs. per ft.	cost per ft.	weight lbs. per ft.	cost per ft.	weight lbs. per ft.	cost per ft.	weight lbs. per ft.	cost per ft.	weight lbs. per ft.
0.5	.89	4.25	1.00	5.10	1.22	6.20			
1.0	1.16	4.65	1.45	5.60	1.75	6.85			
1.5	1.43	5.00	1.91	6.15					
4" FLOAT		HEAVY DUTY SKIRT							
0.5	.96	4.35	1.08	6.40	1.32	7.75			
1.0	1.23	5.75	1.55	6.90	1.85	8.40			
1.5	1.50	6.10	2.00	7.45					
6.5" FLOAT		STANDARD SKIRT							
0.5	1.26	5.80	1.60	6.70	1.81	7.70	1.85	8.35	
1.0	1.76	6.25	2.05	7.20	2.29	8.35	2.37	9.20	
1.5	2.02	6.70	2.32	7.80	2.60	9.10	3.16	10.05	
2.0	2.28	7.30	2.58	8.30	3.13	9.75	3.68	10.90	
6.5" FLOAT		HEAVY DUTY SKIRT							
0.5	1.35	7.10	1.70	8.25	1.92	9.45	1.98	10.30	
1.0	1.83	7.55	2.15	8.75	2.40	10.10	2.50	11.15	
1.5	2.11	8.00	2.42	9.35	2.71	10.85	3.29	12.00	
2.0	2.64	8.60	2.67	9.85	3.24	11.50	3.81	12.85	

AIR BARRIERS

Oil containment with air barriers is effective when current velocities are less than 0.4 feet per second (Shell, 1972). Small horizontal water currents, established by air bubbles issuing from a subsurface manifold, are overcome when this velocity is exceeded.

Specific examples in Montana are not known at this time. However, equipment such as the Hind Air-Aqua System, which is used for aerating sewage treatment lagoons, may be effective.

SKIMMERS

Several considerations are inherent with skimmers. Efficiencies are low with thin oil slicks, floating debris may clog pumps and transfer lines, mobility is low and hydrodynamic stability is poor in the presence of waves (Shell, 1972).

Three basic types of skimmers are commercially available. These are the weir-type, floating suction and sorbent surface.

Oil Hawg (Parker Systems, 1972)

This is a portable floating suction skimmer, suitable for any grade of oil, according to the manufacturer. Nominal pump capacity is 100 gallons per minute. Weight of the skimmer unit alone is 38 pounds.

No distributors for Oil Hawg are presently in the northern Rocky Mountain region. Therefore, this equipment would have to be shipped from the manufacturer in Norfolk, Virginia. Trucking and air freight time to Billings, Montana would be about ten days and three days, respectively. Price lists were not on hand when this plan was prepared.

Parker Systems, Inc.
P. O. Box 1652
Norfolk, Virginia 23501

(703) 543-0647

Industrial Marine Service, Inc., an affiliate of Parker Systems, Inc. is an oil spill contractor. They could respond within 24 hours to an oil spill in Montana. The Oil Hawg is part of their cleanup equipment.

Industrial Marine Service, Inc.
P. O. Box 1652
Norfolk, Virginia 23501

(703) 545-0692

Slickskim (Slickbar, Inc.)

Slickskim is a portable floating suction skimmer, suitable for any grade of oil. Two skimming heads, one for rough water and one for still water,

are available. Slickskin units are also available in two sizes, 60 gpm and 175 gpm for about \$3,700 and \$6,300 (FOB), respectively.

At present, Slickskin equipment is available only by receipt of a special order in Norwalk, Connecticut. Three to four weeks is the estimated time required for manufacturing and shipping to Billings.

SORBENTS

A wide variety of sorbent materials has been used or tested for use in oil spill cleanup. Hay and straw, while efficient and readily available, can become water-logged and sink. This is true of all cellulose-based sorbents such as peat, wood chips, ground corn cobs and sawdust (Shell, 1972).

Shell Oil Company reports that shredded polyurethane foam sorbs up to 50 pounds of oil per one pound of dry foam, the most efficient material they have yet tested (Shell, 1972). National Environmental Research Center's (NERC) testing showed that from 32 to 53 pounds of oil could be sorbed per pound of dry polyurethane foam (Henager and Smith, 1972). Oils tested by NERC were Bunker C and three crude oils with API gravities between 14° and 42°. Good oil recovery and subsequent reuse of foam was also demonstrated.

Specific commercial sorbers are difficult to discuss because they are trade-named and material composition may not be described.

Grefco Sorbers (Grefco, Inc.)

Grefco markets two sorbent materials, Dica-Sorb and Fiberperl. Dica-Sorb absorbs from 3.8 to 6.4 pounds of oil per pound of sorbent and repels water. No specifications for Fiberperl were on hand when this plan was prepared.

Grefco products are used by several industries in Montana and distributors' warehouses are maintained in Washington and Oregon. Montana firms, however, cannot be considered as regular supply sources. Therefore, the home offices should be contacted for the nearest source of supply.

Grefco, Inc.
630 Shatto Place
Los Angeles, California 90005

(213) 381-5081

Limited quantities of Fiberperl are available from Bovaird Supply Company, Casper, Wyoming.

Slickwik (Slickbar, Inc.)

Slickwik consists of the ground, less-dense portion of corn cobs. Sorbent capabilities are about five pounds of oil per pound of dry material,

depending on oil type. Slickwik is manufactured by Anderson Cob Mills, Inc., 521 Illinois Avenue, Maumee, Ohio 43537, (419) 893-6551, and shipped from Toledo, Ohio.

OilSnare (Parker Systems, Inc.)

OilSnare is specifically designed for heavy oil spill absorption and works particularly well at low temperatures. Oleophilic-hydrophobic plastic is extruded into flat fibers which make up individual "snares" of about 0.5 pound each. General appearance is that of a tangled mass of fibers. Specific gravity of the "snare" material ranges between 0.90 and 0.96.

The recovery rate for "snares" is about 60 pounds of oil per one pound of absorbent, according to Parker Systems, Inc. This results in an estimated material cost of about 1.3 cent per one pound of oil. Material cost can be reduced below this by cleaning and reusing the "snares."

Prices and shipping information are given in Table 7. See page 113 for the address of Parker Systems, Inc.

TABLE 7

OILSNARE PRICE AND SHIPPING DATA

OilSnare is priced as follows:

One to four 15-pound boxes	-	\$1.20/pound (\$18 box)
Five to nine 15-pound boxes	-	\$1.00/pound (\$15 box)
Ten or more 15-pound boxes	-	\$0.80/pound (\$12 box)

Shipping information:

Carton: 19.25 inches by 16.5 inches by 18.75 inches
Cubic: 3.37 cubic feet
Gross Weight: 17.5 pounds

BURNING

Several factors detract from burning as an oil spill cleanup alternative (Shell, 1972).

1. Oil layers less than one-eighth inch thick are difficult to burn because the water acts as a large heat sink.
2. Oil that has weathered or becomes emulsified is difficult to burn.
3. The air pollution which results may be undesirable.

4. Removal efficiencies on the open seas have only been 50 to 60 percent maximum.

In addition, an open burning permit must be obtained from the Air Quality Bureau, Environmental Sciences Division, Montana Department of Health and Environmental Sciences.

SINKING

Sinking is generally considered undesirable because of the possibility of environmental damage. Equipment used to distribute the sinking agent is usually expensive and efficiencies generally are limited to 90 percent or less. However, the method is least expensive, probably because sand, chalk and other materials used are not expensive. Sinking works best with oils of high density and viscosity (Shell, 1972).

DISPERSENTS

Dispersents "break up" oil slicks into countless tiny droplets by reducing the interfacial tension between oil and water. However, there are several problems with this approach (Shell, 1972).

1. A number of dispersents are known to be toxic to aquatic community.
2. Besides the spilled oil, another contaminant is added to the environment.
3. The dispersed oil droplet may be readily assimilated into the aquatic food chain.
4. Biological degradation may be low because essential nutrients, such as phosphorous and nitrogen, are lacking.

GELLING AGENTS

No gelling agents are available commercially. When a leak occurs, the agent would be added to the tank and cause rapid gelling (Shell, 1972).

SURFACE TENSION MODIFIERS

Surface tension modifiers contract the area of spilled oil making removal with skimmers or sorbents easier. This is accomplished by reducing the water's surface tension so that the oil contracts rather than spreads (Shell, 1972).

OIL HERDER (R), a product of Shell Oil Company, appears to be an effective surface tension modifier. Reduction factors of 1.3 (Paraffin Oil) to 1,000 (Shallow Yates Crude) were obtained in laboratory tests of several oils. In off-shore tests near Galveston, crude oil was contained for more than four hours in 25 knot winds and four to six foot waves. Recommended application rates are about two gallons per mile of oil slick perimeter. The effectiveness of OIL HERDER (R) is decreased somewhat with low temperatures (Shell, 1972). No information on toxicity was available.

SHELL OIL HERDER (R) is available from:

Shell Oil Company
400-103 Northwest
Bellevue, Washington 98004 (800) 426-7970

Tretolite Division
Petrolite Corporation
Casper, Wyoming (307) 234-8861

June 1, 1972 prices (FOB delivered) are:

54 gallons N.R.S.D.	<u>5 gallons</u>
\$9.25/gallon	\$9.75/gallon

Other surface tension modifiers are available; however, information was not on hand when this report was prepared.



A P P E N D I C E S D T H R O U G H F

APPENDIX D*

POSSIBLE COUNTERMEASURES FOR SOLUBLE COMPOUNDS

The section contains an alphabetical listing of all compounds listed as soluble in the Priority Ranking System and the suggested procedures for neutralizing their damaging effects. The techniques suggested are not necessarily technically feasible at this time, nor is there any guarantee that they will not have effects on the environment of equal or greater severity than the original contaminant. The discussion of response procedures in the text applies to the following suggestions. Similarly, the response code given in the Appendix A printout section follows the steps outlined here. A 'z' in the response code of the computer printout signifies that the countermeasure is considered adequate and feasible at this time with the possible exception of situations where a precipitated sludge might cause problems.

Acetaldehyde (Ethanal, acetic aldehyde, ethylaldehyde)

Miscible with water - powdered carbon treatment with removal of carbon might be attempted.

Acetic acid

Treat water with NaHCO_3 to reduce acidity - dilute.

Acetone (Dimethyl ketone)

Miscible with water - powdered carbon treatment and/or dilution only possibilities for water.

Acetone Cyanohydrin (a - hydroxyisobutyronitrile)

Danger from HCN gas generation - treat contaminated water with NaHCO_3 or $\text{Ca}(\text{OH})_2$ to maintain high pH and suppress HCN - or precipitate CN^- with Fe^{+3} or chlorinate.

Styrene (Styrol, styrolene, vinyl benzene)

Only sparingly soluble in water - density - 0.90; therefore, it floats on water for most part - could probably be removed with available oil spill equipment - powdered charcoal treatment for contaminated water may be possible.

Acetonitrile (Methyl cyanide, cyanomethane)

Density - 0.77 at 30°C - miscible with water - flash point = 55°C - HCN generation hazard - add NaHCO_3 to contaminated water to suppress HCN formation - treat with powdered charcoal to remove CH_3CN from water - also can precipitate CN^- with Fe^{+3} or degradation by chlorination.

Acetophenone (Hypnone, phenyl methyl ketone)

Slightly water soluble - usually liquid - mp = 20.5°C - density = 1.033 - probably would sink to bottom - bottom recovery required - powdered carbon treatment for water soluble fraction if possible.

*The material in this section has been copied from Control of Spillage of Hazardous Polluting Substances.

Acid, Acylhalides and Anhydrides

Some are violently decomposed by contact with water - acid and chlorine are the decomposition products - powdered carbon treatment of contaminated water might be attempted.

Acrylic Acid (propenoic acid, vinylformic acid)

Miscible with water - corrosive, heavy liquid - polymerizes readily in the presence of oxygen - add NaHCO_3 to raise pH - possibly absorb on powdered carbon.

Acrylonitrile (propenonitrile, vinyl cyanide, cyanoethylene)

CO_2 from air is enough to liberate HCN gas. Treat contaminated water with $\text{Ca}(\text{OH})_2$ immediately to prevent HCN generation - or precipitate CN^- form with Fe^{+3} or chlorinate.

Misc. Acyclic Insecticides

Many are only slightly water soluble - float on water - skimming may be necessary - powdered carbon treatment to remove water soluble remainder might be attempted.

Adipic acid (hexanedioic acid)

100 ml of saturated water contains 1.44g at pH 2.7 - Recover solid from bottom-adsorb dissolved material on powdered carbon and recover, if feasible - add NaHCO_3 .

Aldehydes and Ketones

All aldehydes heavier than pentanal ($\text{C}_4\text{H}_9\text{CHO}$) are water insoluble - the ketones heavier than diethyl ketone ($\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$) are only sparingly water soluble - acetone is the most water soluble - ketones light liquids - floating on water - skimming indicated in some cases - insoluble aldehydes also float on water - treatment of water soluble aldehydes is described under formaldehyde and acetaldehyde.

Aldrin - Toxaphene Group (Octalene - chlorinated camphene group)

Ordinarily nearly water insoluble - can be formulated as oil emulsion or wettable oil emulsion, skimming recovery equipment needed - as wettable dust, desedimentation needed (polyelectrolyte and powdered carbon + alum). Toxaphene is a waxy solid that dehydrochlorinates in the presence of alkali.

Aluminum fluoride

Sparingly soluble in water - 0.6g/100 ml - treat contaminated water with $\text{Ca}(\text{OH})_2$ to bring down CaF_2 - pH of water can then be adjusted with soda.

Aluminum sulfate

Treat contaminated water with NaHCO_3 to insure precipitation of aluminum hydroxide.

Amines, total

Lower members of the series, to hexylamine, are very soluble in water - aromatic amines discussed elsewhere (aniline, diphenyamine) - powdered carbon treatment of contaminated water might be attempted.

Ammonia

Very soluble in water - possibly dilute acetic acid for treatment - dilution.

Ammonium acetate

Dilution only feasible response.

Ammonium chloride

Dilution only feasible response.

Ammonia Compounds (Ammonium Compounds)

Dilution only practical treatment.

Ammonium Nitrate

1 g dissolves in 0.5 ml water at 20° C - dilution may be only practical treatment method.

Ammonium Perchlorate

Freely soluble in water - would slowly go over to ammonium chloride in contact with reducing materials such as organics on stream bottom - dilution only possible treatment.

Ammonium sulfate

Add $\text{Ca}(\text{OH})_2$ to raise pH and remove NH_3 from water and ppt CaSO_4 - dilute.

Amyl Alcohol, commercial (isoamyl alcohol, isopentyl alcohol)

Slightly soluble in water - density = 0.83 - floats - skimming required and possibly powdered carbon treatment.

Aniline (phenylamine, aminobenzene)

1 g dissolves in 28.6 ml water - reacts with acids and alkalies to form water soluble salts. Removal might be accomplished by treatment of water with powdered carbon.

Antimony Compounds

Add NaHCO_3 or $\text{Ca}(\text{OH})_2$ to precipitate antimony as an insoluble basic salt - recover precipitate.

Arsenic Compounds

Scavenge with alum floc to tie up arsenic in insoluble form - recover floc if possible.

Barium Carbonate

Almost insoluble in water - add Na_2SO_4 to precipitate less soluble BaSO_4 .

Benzaldehyde (Benzoinic aldehyde)

Soluble in 350 parts of water - very soluble in oils and gasoline - density = 1.04 - barely sinks in seawater - oxidizes in air to benzoic acid - oil skimming if in contact with oil - powdered carbon treatment for water soluble fraction might be possible.

Benzene (Benzol, cyclohexatriene)

One part soluble in 1430 parts water - miscible in oil - density = 0.88 - skimming necessary to remove.

Benzoic Acid (Benzene carboxylic acid, phenylformic acid)

Solubility = 2.9 g/l at 25°C - add NaHCO₃ to produce sodium benzoate - human tolerance for this is up to 50 g/day.

Benzoyl peroxide (Lucidol)

Sparingly soluble in water - recover solid from bottom - use powdered carbon to remove water soluble portion if possible.

Boric Acid (H₃BO₃)

pH = 5.1 at 0.1 M - precipitate less soluble calcium borate with addition of Ca(OH)₂ - dilute - recover precipitate.

Bromine

One ml dissolves in thirty mls water - very heavy liquid - density = 3.1 at 20°C sinks to bottom - bottom recovery required - powdered carbon treatment for water soluble fraction if feasible.

n-butyl acetate (Butyl ethanoate)

Soluble in 120 parts water at 25°C - density = 0.88 - much of the spill will remain floating so skimming probably necessary - powdered carbon removal of water soluble fraction if possible.

Normal & Isobutyl Alcohol (butyl alcohol; 2 methyl-1-propanol)

Both fairly soluble in water - powdered carbon treatment might be attempted - also dilution.

Butyl Amines (n, sec, tert - Butylamine)

Miscible with water - ammonia odor - powdered carbon treatment of contaminated water if feasible.

Butyric acid (ethylacetic acid, butanoic acid)

Miscible with water - neutralize with Ca(OH)₂ - possibly try adsorption of butyrate on powdered carbon - dilute.

Calcium Carbide

Evolves acetylene in water leaving Ca(OH)₂ - treat with Na₂CO₃ if desirable to precipitate CaCO₃ and lower pH.

Calcium chloride

Freely soluble in water with liberation of heat - add Na₂CO₃ to precipitate CaCO₃.

2,4,5,-T acid esters and salts (esters and salts of 2,4,5-trichlorophenoxyacetic acid)

Esters nearly water insoluble - sodium salt water soluble - powdered carbon treatment may be feasible for soluble fraction.

Calcium hypochlorite

Very water soluble - decomposes much more readily than sodium hypochlorite - little can be done except dilution.

Calcium phosphate, Dibasic (CaHPO₄)

Slightly soluble in water - Ca(OH)₂ can be added to make even less soluble by the common ion effect.

Carbon disulfide (carbon bisulfide)

Slightly water soluble - <0.005% - miscible in oils and gasoline - oil skimming if in contact with oil - powdered carbon treatment of contaminated water for soluble fraction - density = 1.25, therefore, it sinks in water - use heavy liquid recovery system.

Carbon tetrachloride (Tetrachloromethane, perchloromethane)

1 ml dissolves in two liters of water - density = 1.59, therefore, most would sink to bottom of water body - bottom recovery methods would be in order.

Chlorinated Isocyanurates

Soluble in water - add $\text{Ca}(\text{OH})_2$ to suppress formation of hypochlorous acid - powdered carbon treatment might be attempted.

Chlorine

0.7 wt% soluble in 20°C water (2.3 volumes of Cl_2 at STP). Powdered carbon treatment may be worth a try but probably will not be very successful - soluble in basic solutions but not much help to fish - large fish kills probable.

Chloroform (Trichloromethane)

One part soluble in 200 parts water at 25°C - density = 1.48 - sinks in water - insoluble fraction will have to be recovered from bottom - carbon treatment for soluble fraction may be possible.

Chloromethane (methyl chloride)

Slightly soluble in water - evaporates quickly producing a temperature of -23°C to -50°C. Powdered carbon treatment may be in order to remove water soluble fraction - density at 24° C = 1.0.

Chlorosulfonic Acid (Sulfuric chlorhydrin)

Very corrosive - explosive decomposition - Treatment of contaminated water with calcium hydroxide or sodium bicarbonate.

Chromic Acid (Chromium trioxide)

Neutralize with NaHCO_3 to produce chromic carbonate which is practically water insoluble.

Citric acid

64 wt% citric acid solubility at 30°C - citrate solubility can be reduced to one part in 1050 parts water by addition of $\text{Ca}(\text{OH})_2$ with formation of calcium citrate.

Copper sulfate

Use potassium ferrocyanide to precipitate a reddish copper ferrocyanide which is very insoluble - ferrocyanides are of a very low toxicity order - they can pass through the stomach without breakup into HCN.

Cresols (cresylic acid, cresylol, tricresol)

Similar action to phenol - powdered activated carbon treatment of contaminated water if possible.

Cyclic Herbicides, Misc.

Many are only slightly water soluble - float on water - skimming may be necessary - powdered carbon treatment to remove water soluble remainder may be attempted.

Cyclic Insecticides, Misc.

Treat contaminated water with powdered activated carbon, if possible.

Cyclic Insecticides and Rodenticides

Activated charcoal treatment if practical, of water in spill - otherwise dilution to < 20 mg/l for strychnine, same order of magnitude for rotenone, which also rapidly decomposes in heat and light.

Cyclohexanol (Hexalin, hexahydrophenol)

3.6 wt% soluble in water at 20°C - heavy solid - may have to recover solid from bottom - adsorption of contamination on powdered carbon may be possible.

Cyclohexanone (Ketohexamethylene)

Solubility in water - 50 g/l at 30°C - density = 0.94 at 25°C - may have to skim after spill - if feasible use powdered carbon for removal of soluble portion.

Cyclohexylamine (Hexahydroaniline, aminocyclohexane)

Miscible with water - powdered carbon removal with pickup of the used carbon.

DDT (dichlorodiphenyltrichloroethane)

Practically insoluble in water - if wettable, will have to be recovered by desedimentation techniques possibly using alum floc and a polyelectrolyte - powdered carbon could be added, also, to insure soluble DDT uptake and removal.

1,2-Dibromo 3-chloropropane (DBCP, Fumazone, Nemagon)

Slightly soluble in water - density = 2.1 at 14° C sinks to bottom - must be recovered from bottom - possibly powdered carbon treatment of dissolved material.

Dibutyl phthalate (n-Butyl phthalate)

One part soluble in 2500 parts of water - density = 1.05 - sinks in water - insoluble fraction recovered from bottom - possibly carbon treatment for soluble fraction.

Dichlorobenzenes (m-, o-, and p-Dichlorobenzene)

Heavy liquids - density averages 1.3 - practically water insoluble - sinks to bottom - bottom recovery necessary with powdered carbon treatment of contaminated water if feasible.

2,4-D Acid (2,4-dichlorophenoxyacetic acid, Hedonal)

Almost water insoluble - soluble in oil - oil skimming required if oil contacted - otherwise powdered carbon treatment for water soluble fraction.

2,4-D Esters and Salts (2,4-dichlorophenoxyacetic acid esters and salts)

Salt solubility in water = 3.5% - ester is a heavy liquid soluble in oil - oil skimming in order - possibly powdered carbon treatment for water soluble fraction.

Diethylamine

Miscible with water - strongly alkaline light liquid - neutralize with dilute acetic acid - adsorb on powdered carbon if possible.

Diethanolamine (2,2'-Iminodiethanol, diethyloamine)

Sold as a liquid - miscible with water - lower pH with dilute acetic acid - absorb water soluble fraction on powdered carbon if possible.

Diethylene glycol (2,2'-Oxydiethanol, diglycol)

Miscible with water - water-glycol mixtures sink, though - powdered carbon treatment with collection of solid sludge.

Ethanolamine (Monoethanolamine)

Miscible with water - strongly basic - treat water with dilute acetic acid and adsorb on powdered carbon if possible.

Ethers, total

Slightly soluble in water - very soluble in oils, oil skimming called for if oil contacted. Powdered carbon treatment may be tried for water soluble fraction.

Esters of Monohydric Alcohols

Mostly water soluble - heavy liquids - fatty acid enters water insoluble - bottom recovery required - powdered carbon treatment necessary for water soluble esters.

Ethanolamines (mono, di, and triethanolamines)

Miscible with water - strong base - neutralize with dilute acetic acid - treat with powdered carbon if feasible.

Ethyl Acetate

One ml dissolves in ten ml water at 25°C - density = 0.90 - floats slowly decomposed by water acquiring an acid reaction - rapid skimming followed by powdered carbon treatment if possible.

Ethyl Acrylate (Acrylic acid ethyl ester)

Fairly soluble in water - easily polymerizes on standing to a non-toxic transparent substance - heat, light and peroxides (H_2O_2) speed up polymerization - density = 0.94 - floats on water - skimming to remove bulk - possibly powdered carbon treatment for water soluble fraction.

Ethyl Alcohol (Ethanol, alcohol)

Dilution only practical treatment for contaminated water.

Ethylamine (Monoethylamine, aminoethane)

Strong alkaline reaction - miscible in water - powdered carbon treatment may be possible - allow to remain alkaline to avoid splitting off CN gas.

Ethylbenzene

Density = 0.87 at 25°C - practically insoluble in water - floats on water surface - skimming, with powdered carbon treatment for water soluble fraction might be attempted.

Ethylene (Ethene)

One volume of gas dissolves in nine vol of water at 25°C - powdered carbon treatment of contaminated water might be attempted - otherwise dilution.

Ethylenediamine (1,2-Diaminoethane)

Freely soluble in water - strongly alkaline in reaction - add dilute acid to form diacetate - powdered carbon treatment for removal if feasible.

Ethylene Glycol (1,2-Ethanediol)

Miscible with water - probably even glycol - water mixtures (density at 50/50 mixture = 1.08) are dense enough to sink to bottom - solids removed from bottom and possibly powdered carbon treatment.

Ethylene Oxide (Oxirane, Anprolene)

Soluble in water - powdered carbon treatment for contaminated water.

Ethylenimine (Ethylene imine, Aziridine, dimethylenimine)

Miscible with water - polymerizes easily - strongly alkaline - add dilute acetic acid to neutralize - adsorb on powdered carbon if possible.

Ethyl Ethers, all

Water contains 6 wt% ether at 25°C - most of the ether would float, but too dangerous (fire hazard) to skim - possibly treat with powdered carbon for soluble ether.

Ethyl Formate

One part soluble in ten parts water with gradual decomposition into formic acid and ethanol - density at 20°C = 0.92 - floats - rapid skimming with powdered carbon treatment if possible.

2-Ethylhexylacrylate (Octyl acrylate)

Liquid very slightly soluble in water - density - 0.89 at 20°C - floats - rapid skimming followed by powdered carbon treatment if possible.

Fatty Acids (Stearic, oleic, linoleic acids)

Very slightly water soluble - most float on water - soluble in oils and gasoline - oil skimming for removal.

Ferbam (dimethylthiocarbamic acid, Carbamate)

Solubility in water = 120 ppm - recover solid from bottom - use powdered carbon to remove water soluble fraction if possible.

Ferrous sulfate

Water soluble - precipitate as a hydroxide by NaHCO₃, buffering.

Fluorine, hydrofluoric acid

Add Ca(OH)₂ to contaminated water to precipitate harmless CaF₂.

Formaldehyde Solution (Formalin, Formol)

Very water soluble - ammonium acetate transforms formaldehyde to much less toxic methenamine - add ammonium salts if practical - powdered carbon treatment also could be effective.

Formic Acid

Liquid miscible with water - caustic to skin - neutralize with $\text{Ca}(\text{OH})_2$ - possibly try adsorption of formate on powdered carbon - dilute.

Fumaric acid (trans - Butenedioic acid)

0.63 g soluble in 100 ml water at 25°C - recover solid from bottom - possibly adsorb dissolved material on powdered carbon.

Fungicides, Acyclic

Not very water soluble - powdered carbon treatment is a possibility.

Fungicides, Misc.

Most are not very water soluble - adsorption on powdered carbon only possibility.

Fungicides, total cyclic

Most nearly water insoluble - powdered carbon treatment only practical removal method.

Furfural (2-Furaldehyde)

One part soluble in eleven parts water - density = 1.16 - sinks in water - carbon treatment with recovery of carbon for soluble fraction.

Furfuryl Alcohol (2-Furylcarbinol, 2-Furancarbinol)

Miscible with water but unstable in water - easily resinified by acids - add dilute acetic acid to speed up resinification - powdered carbon treatment may be possible.

Glycerine, syn. & nat. (Glycerol)

Heavy liquid miscible with water - probably water and glycerol mixtures all sink to bottom - powdered carbon treatment for removal may be possible - dilution.

Glyoxal (Ethanedral, oxalaldehyde, biformyl)

Solid polymerizes quickly on contact with water with violent reaction - sold as solid or as 40% aq. soln. containing polym. inhibitors - powdered carbon treatment for aqueous solution may be possible.

Halogenated Hydrocarbons

Most practically water insoluble - quite soluble in oil and gasoline - skimming equipment use in order if oil slicks are present - powdered carbon treatment to remove water soluble fraction may be attempted.

Herbicides and Plant Hormones

Treatment of contaminated water with powdered carbon with precipitation of sludge or filtration - acute human toxicity - little can be done about water soluble fraction except perhaps powdered carbon treatment.

Herbicides and Plant Hormones, acyclic

Variable water solubilities - usually slightly soluble - there are 14 gibberellins (plant hormones) for example - all are slightly soluble solids. Most herbicides more water soluble - powdered carbon treatment for water soluble fraction if feasible - recovery of solids from bottom of water body.

1,6-Hexanediamine (Hexamethylenediamine)

Freely water soluble - powdered carbon treatment of contaminated water might be attempted.

1-Hexanol (n-hexyl alcohol)

Slightly soluble in water - density = 0.81 at 35°C - floats on water - skimming probably required - adsorption on powdered charcoal for dissolved material if possible.

Hydrochloric Acid (Muriatic acid)

Neutralize with sodium bicarbonate, dilute.

Hydrocyanic Acid (Hydrogen Cyanide)

Add $\text{Ca}(\text{OH})_2$ to suppress formation of HCN gas or chlorinate or attempt precipitation with Fe^{+3} - little else can be done besides dilution.

Hydrogen Peroxide

Make water alkaline with NaHCO_3 to speed decomposition of peroxide - dilute.

Hypochlorites

Addition of NaHCO_3 will speed Cl_2 evolution and hypochlorite breakdown, but fish will still suffer toxic effects.

Lactic Acid (D-lactic acid, DL-lactic acid, L-lactic acid)

Soluble in water - possibly powdered carbon treatment - dilution.

Lead Arsenate

Use alum floc to remove arsenate by adsorption - add $\text{Ca}(\text{OH})_2$ to precipitate insoluble basic lead carbonate - recover precipitates.

Lead - Compounds

Very difficult to recover - perhaps dithizone or EDTA followed by adsorption of the lead complex with powdered carbon treatment.

Lindane (HCH; 1, 2, 3, 4, 5, 6 - hexachlorocyclohexane)

Insoluble in water - white powder - has to be removed as a sediment, if suspended in water - alum and polyelectrolyte treatment might be attempted.

Isooctyl Alcohol (a mixture of isomeric, branched-chain primary alcohols)

Only very slightly soluble for most part - density = 0.8 - floats on water - skimming required for recovery - powdered carbon treatment for water soluble fraction if possible.

Isoprene (2 - Methyl - 1,3 - butadiene)

Liquid practically insoluble in water - density = 0.68 - floats on water - remove floating isoprene with oil spill equipment - possibly treat contaminated water with powdered activated carbon.

Isopropyl Acetate

One part soluble in 23 parts of water at 27°C - liquid density = 0.87 at 20°C - floats - rapid skimming followed by powdered carbon treatment if possible.

Isopropylacetone (Methyl Isobutyl Ketone, hexone)

Liquid moderately soluble in water (1.91 wt%) - density = 0.80 at 20°C - rapid skimming and powdered carbon treatment if possible.

Isopropyl Alcohol (Isopropanol, 2 - propanol)

Miscible with water - can be salted out of aqueous mixtures but too much salt is required to do this - not very feasible - powdered carbon treatment and dilution is probably only practical treatment.

Isopropylamine (2 - aminopropane)

Miscible with water - strong base - neutralize with dilute acetic acid - remove with powdered carbon adsorption if possible.

Isopropyl ether (diisopropylether)

Slightly soluble in water (0.2 wt% at 20°C - density = 0.73 at 20°C) - floats - rapid skimming, if not too hazardous, followed by powdered carbon treatment if possible.

Magnesium Compounds

Ppt. Mg(OH)₂ with Ca(OH)₂ - remove excess Ca with soda softening (Na₂CO₃).

Magnesium Sulfate

Magnesium can be precipitated as Mg(OH)₂ by Ca(OH)₂ - calcium sulfate can be reduced by soda softening if desired.

Maleic Anhydride (cis-Butendioic anhydride, Toxiclic anhydride)

Solid briquettes - water soluble - possible bottom recovery if fast enough - powdered carbon treatment for remainder if feasible.

Methyl Acetate

Soluble in water - liquid density = 0.93 - possibly powdered carbon treatment for removal - perhaps skimming of floating material.

Methyl Alcohol (Methanol, carbinol, wood alcohol).

Ethanol inhibits the metabolic oxidation of methanol - perhaps some ethanol and bicarbonate might be added to methanol spill if there is immediate danger of ingestion - otherwise dilution is the only practical means of spill dissipation.

Methylamines

One volume of water dissolves 959 volumes of gas - a stronger base than ammonia - perhaps powdered carbon treatment would be effective.

Methyl Ethyl Ketone (Ethyl Methyl Ketone, 2-Butanone)

1 pt. soluble in 4 pts. water - powdered carbon treatment for spills is a possibility.

Methyl Methacrylate (Methacrylic acid)

Very slightly soluble in water - density - 0.94 at 20°C - Oil skimming required, powdered carbon treatment of water soluble fraction, if possible.

Methyl parathion (0,0-Dimethyl 0-p-nitrophenyl phosphorothioate)

50 ppm water solubility of crystals - density = 1.36 at 20°C - sinks to bottom - bottom recovery necessary with powdered carbon treatment for water soluble fraction if feasible.

Mercury Compounds

BAL (Dimercaprol), a water soluble mercaptan, is recommended as a chelating agent for mercury - however, this is not of much value if the Hg is still in solution - add Na_2CO_3 to bring down insoluble carbonate - recover carbonate from bottom.

Mercury Fungicides

Usually metallo-organics that can be removed by powdered carbon if such treatment is feasible.

Monohydric Alcohols, unsubstituted

Powdered carbon treatment for water soluble alcohols might be attempted - alcohols through butanol are infinitely soluble in water - becomes less soluble through nonanol - water insoluble with solid after decanol - the infinitely soluble alcohols can be made to separate from aqueous solution by addition of potassium carbonate - water then would require skimming to remove alcohol and treatment of water for contained K_2CO_3 .

Morpholine (Tetrahydro-2H-1,4-oxazine)

Liquid miscible in water - strong, corrosive base - neutralize with dilute acetic acid - adsorb on powdered carbon if possible.

Nabam (Dithane D-14)

Moderately soluble in water - probably must rely on powdered carbon treatment due to relatively high solubility.

Naphthalene

Powdered carbon treatment may be possible.

Nickel Compounds

Mostly water soluble - Nickel forms a water insoluble complex with dimethylglyoxime (pinkish red) that is used in cosmetics, hence probably not toxic - as a stopgap, add dimethylglyoxime dissolved in Ethanol to nickel spill - remove nickel complex by use of alum and powdered carbon and polyelectrolyte.

Nickel Sulfate

One part soluble in 1.4 parts water - add $\text{Ca}(\text{OH})_2$ to form insoluble $\text{Ni}(\text{OH})_2\text{H}_2\text{O}$ - recover ppt. if desired.

Nitric Acid

Lower pH of contaminated water with NaHCO_3 or $\text{Ca}(\text{OH})_2$ - dilute resulting nitrates.

m-Nitroaniline (m-Nitraniline)

One gram dissolves in 880 ml of water - density of solid = 0.90 - floats on water - recovery by skimming equipment - caustic in reaction, but since the salt is much more soluble than the base, it probably should not be neutralized - adsorb dissolved material on powdered carbon if feasible.

Nitrobenzene (Nitrobenzol)

Density = 1.21, therefore, it sinks in water - one part soluble in 500 parts water - freely soluble in oils and gasoline - oil skimming would be in order if oils are contacted - bottom recovery equipment needed if spilled into water body - powdered carbon treatment might be attempted for soluble fraction.

Nitrophenols (o - and p - nitrophenol)

Para most toxic - moderately water soluble - adsorption on powdered carbon is the only possibility.

Nitrous Oxide (laughing gas, dinitrogen monoxide)

At 20°C and 1 atmos., 1L of gas dissolves in 1.5L of water - No HNO₃ formed - no treatment required.

Nonyl Phenol (mixture of Monoalkyl phenols)

Practically water insoluble - density = 0.95 - floats on water and therefore can be removed with oil spill equipment - contaminated water may be treated with powdered activated carbon.

Oxalic Acid

Add Ca(OH)₂ to precipitate as relatively unsoluble calcium oxalate - recover precipitate if possible - recover solid oxalic acid.

Parathion (Niran, DNTP, DPP, E-605, Thiophos 3422)

20 ppm soluble in water - heavy liquid - density = 1.26 at 25°C - sinks to bottom - bottom recovery necessary - powdered carbon treatment to remove water soluble parathion if possible.

Pentachlorophenol (Penta)

A solid - density = 1.978 - sinks in water - almost water insoluble - bottom recovery necessary - carbon treatment for water soluble fraction, if feasible.

Pentane (n-pentane)

360 ppm soluble in water at 16°C - density = 0.61 at 30°C - floats on top of water - skimming required - powdered carbon adsorption for dissolved material may be possible.

Perchloric Acid

Treatment of contaminated waters by addition of lime or NaHCO₃ (sodium bicarbonate) - otherwise dilution.

Pesticides, Insecticides, Acyclic

Powdered carbon treatment of contaminated water for water soluble fraction, if feasible - oil skimming if in contact with oil.

Phenol (carbolic, phenic, phenyl hydroxide, hydroxybenzene)

Solid - 1g dissolves in 15 mL water - if spill area is reasonably small in size, and can be contained, powdered charcoal treatment becomes possible - precipitate with a coagulant - physical sludge removal. If spill is in a large water volume, dilution may be the only treatment - any amount dangerous - pH of aqueous solutions = 6, forms water soluble salts with bases.

Phenylmercuric Acetate (Acetoxyphenylmercury, PMA)

1 part soluble in 600 parts water - solid - powdered carbon only possible treatment.

Phosphoric Acid

Lime, Ca(OH)₂, to neutralize and precipitate calcium phosphate.

Phosphorus

Three forms - white, black and red.

White - Very soluble in water - ignites at 30°C - cover with water - retrieve physically from underwater - fairly soluble in oil and gasoline - oil skimming if in contact with oil - other two forms are less soluble in organics and can be physically retrieved without combustion.

Phosphorus Oxychloride (phosphoryl chloride)

Soluble in water with decomposition and heat to chlorine and phosphoric acid - add NaHCO₃ to neutralize phosphoric acid produced.

Phosphorus Pentasulfide (phosphoric sulfide, phosphorus persulfide)

H₂S generation - suppress with addition of Ca(OH)₂ or NaHOO₃ to contaminated water.

Phosphorus Trichloride

Soluble in water with liberation of much heat - heavy (density = 1.57), clear liquid - decomposes in water to phosphoric acid and Cl₂ - add Ca(OH)₂ to precipitate and neutralize H₃PO₄.

Phthalic Anhydride

Solid - one part soluble in 162 parts water - density = 1.53 - recovery from bottom required along with powdered carbon treatment for water soluble fraction if feasible.

Polyhydric Alcohols and Esters (polyhydroxy alcohols and esters)

Some solid - some liquids - freely soluble in water - adsorption on powdered carbon is a possibility.

Potassium Compounds

For the hydroxide, add acetic acid to neutralize - otherwise dilute.

Potassium Hydroxide

Treatment with dilute acetic acid to lower pH - dilution of potassium acetate.

Potassium Iodide

Solubility = 1.4 g/ml water - very slowly oxidizes to give elemental iodine - dilution only practical treatment.

Potassium Pyrophosphate

Add Ca(OH)₂ to precipitate insoluble Ca(PO₄)₂.

Potassium Sulfate

Dilution best treatment practical for a water spill.

Propionic Acid (Methylacetic acid, propanoic acid)

Oily liquid - density = 0.98 at 30°C - barely floats - miscible with water - can be salted out of water solutions by CaCl₂ or other salts (probably not very soluble in seawater) rapid skimming along with powdered carbon treatment may be feasible.

Propyl Acetate (acetic acid n-propyl ester)

1.6 g/100 ml water, solubility at 16°C - density = 0.88 at 20°C - floats on water - skimming probably required - possibly powdered carbon treatment for soluble fraction.

n-Propyl Alcohol (propylic alcohol, 1-propanol)

Miscible in water - Powdered carbon only possible treatment.

Propylamines

Usually miscible with water - alkaline - neutralize with dilute acetic acid - adsorb on powdered carbon if possible.

Propylene (propene)

Gas - shipped as liquid in cylinders at 136 psi - very slightly soluble in water - powdered carbon treatment for removal from water may be feasible.

Propylene Dichloride (1,2 - Dichlorophosphane)

Liquid slightly soluble in water - density = 1.16 - therefore sinks in water - bottom recovery necessary along with powdered carbon treatment of soluble fraction if feasible.

Propylene Glycol

Miscible with water - liquid with about same density as seawater - possibly powdered carbon treatment for removal - dilution.

Propylene Oxide (Propene Oxide)

One part soluble in 100 parts water - density = 0.86 - floats - skimming is in order along with powdered carbon treatment for removal of dissolved fraction if possible.

Pyridine

Density = 0.97, miscible in water - soluble in oil and gas - oil skimming where there is oil contact - powdered carbon treatment of contaminated water if feasible.

Silver Cyanide

Insoluble in water - add NaHCO₃ to stabilize and recover from bottom - chlorinate.

Silver Nitrate

Add NaCl to precipitate AgCl - recover AgCl precipitate.

Sodium Acetate

Dilution only practical treatment.

Sodium Borate

Precipitate much less soluble calcium borate by addition of Ca(OH)₂ - remove precipitate from bottom.

Sodium Carbonate

Usually too high in pH to leave untreated - neutralize with dilute acetic acid.

Sodium Chlorate

Very water soluble - neutral pH in solution - dilution is only practical treatment.

Sodium Chromate

Add Fe^{+3} and NaHCO_3 to precipitate Ferric chromate.

Sodium Compounds

Dilution is only practical treatment for most - caustic can be treated with dilute acetic acid.

Sodium Fluoride

Add Ca(OH)_2 to precipitate insoluble CaF_2 .

Sodium Hydrosulfite

Very soluble in water - oxidizes to bisulfite then to bisulfate - acidic - add NaHCO_3 to neutralize acidity - dilute.

Sodium Hydroxide

Add dilute acetic acid to neutralize.

Sodium Metal

Strong caustic former - add dilute acetic acid to lower pH.

Sodium Methylate (Sodium methoxide)

Solid decomposes in water to NaOH and CH_4 - add dilute acetic acid to neutralize - dilute.

Sodium Phosphates (monobasic, dibasic and tribasic)

Ca(OH)_2 precipitates all sodium orthophosphates - methaphosphates not well precipitated unless 4/1 excess lime to phosphate weight ratio is added - precipitates quite insoluble.

Sodium Silicate

Acidify and flocculate with dilute acetic acid.

Sodium Sulfate

Best to allow dissipation of this by dilution when spilled in water.

Sodium Sulfide (sodium monosulfide)

Addition of NaHCO_3 or Ca(OH)_2 to suppress formation of H_2S .

Sodium Sulfite

Oxidizes in air to sulfate - dilution only practical removal method - oxidation of large water body impractical.

Sorbitol (d-Sorbitol, Sorbol, D-Sorbite, hexahydric alcohol)

Freely soluble in water - heavy liquid - pH = 6.7 - probably sorbitol-water mixtures sink to bottom - powdered carbon treatment for removal may be possible.

Sulfur Dioxide

Forms sulfurous acid in water (H_2SO_3) - add NaHCO_3 to speed up process of SO_2 emission.

Sulfuric Acid (Oil or vitriol)

Treatment of contaminated water with NaHCO_3 or Ca(OH)_2 .

Tertiary Butyl Hydroperoxide

Slightly soluble in water - density = 0.9 at 20°C - floats as liquid on water - skimming necessary in case of spill - powdered carbon treatment of dissolved fraction if possible.

Tetraethylene Glycol

Heavy liquid miscible with water - powdered carbon treatment may be effective.

Tetraethyl Lead (Lead tetraethyl)

Acute human toxicity - nearly insoluble in water - density = 1.65 - sinks to bottom of water - very difficult to recover - perhaps complexing with calcium salt of EDTA and dimercaprol (BAL) might be used as a stop-gap measure.

Tetralin (1, 2, 3, 4-Tetrahydronaphthalene)

Insoluble in water - density = 0.96 at 25°C - floats - skimming required.

Tetramethyl Lead (Lead tetramethyl)

Soluble in oil - insoluble in water - oil skimming if contacted by gasoline or oils - possibly powdered carbon treatment for soluble fraction - possible lead complexing with Ca EDTA salt - density = 1.99 - sinks in water - both recovery methods.

Toluene (Toluol, methylbenzene, phenylmethane)

Very slightly soluble in water - density = 0.87 at 20°C - floats on top - use skimming to remove - powdered carbon could be added to remove small water soluble amount.

Trichloroethane (Vinyl Trichloride)

Heavy liquid - density = 1.46 at 20°C - practically water insoluble - bottom recovery equipment needed in case of spill into water body.

Trichloroethylene (Trichloroethene, ethynyl trichloride)

Heavy liquid (density = 1.46 at 20°C) - practically insoluble in water - sinks to bottom - must be recovered from the bottom - slowly decomposes in light to form HCl.

2,4,5-Trichlorophenol + Salts (Dowicide 25, Omal)

Weakly acidic - sodium salt much more water soluble than the acid - powdered carbon treatment is the only possibility other than dilution.

2,4,5-T Acid (2,4,5-Trichlorophenoxyacetic Acid)

Acid nearly water insoluble - soluble in oils - solid has to be recovered from the bottom - oil skimming if in contact with oil - powdered carbon treatment for removal of water soluble fraction, if feasible.

Triethanolamine (2,2',2"-Nitrilotriethanol)

Miscible with water - strong base - neutralize with dilute acetic acid - remove salt on powdered carbon if possible.

Triethylene Glycol

Miscible with water - heavy liquid - probably glycol - water mixtures sink to bottom - powdered carbon treatment if possible - dilution.

Trimethylamine

Gas - soluble in water - sold as 25% H₂O solution or liquified gas - sorption on powdered carbon might be attempted.

Turpentine

Water insoluble - density = 0.86 - floats on water - could be retrieved by skimming.

Urea (carbamide)

One gram dissolves in one ml water - pH of 10% water solution = 7.2 - dilution is probably best removal method.

Vinyl Acetate

Water solubility 1/g/50 ml - density = 0.93 - floats - polymerizes in light to a solid mass - oil skimming and powdered carbon treatment may be effective.

Xylenes (Xylools)

Nearly insoluble to insoluble in water - density = 0.85 - 0.9 - floats on water - skimming called for - powdered carbon treatment may be attempted for any water soluble fraction - very soluble in oil and gasoline.

Zinc Acetate

Add Ca(OH)₂ to precipitate insoluble Zn(OH)₂ - remove precipitate.

Zinc Chloride

Add NaHCO₃ to precipitate the insoluble basic zinc carbonate - recover precipitate if possible.

Zinc Sulfate

Add NaHCO₃ to precipitate insoluble basic zinc oxide - recover precipitate if possible.

APPENDIX E*

ENVIRONMENTAL FACTORS

Appendix E illustrates the usage of a general dispersion model for a soluble pollutant in two possible aquatic environments. This is followed by a summary of present knowledge concerning the chemical and biological interactions affecting DDT released to the aquatic environment. These examples should help illuminate the complexities involved with predicting the environmental fate of hazardous materials after a spill accident.

*The material in this section has been taken from Control of Spillage of Hazardous Polluting Substances.

General Model for Dispersion of Soluble Pollutants

In a turbulent body of water there are two phenomena that will significantly affect the movement of a contaminant once it has been released: convection and eddy diffusion. Convection is the result of current velocity patterns in the water body, while eddy diffusion is dependent upon the natural turbulence of the water within the current structure. The two forces work in conjunction with convection currents transporting the contaminant plume and eddy currents enlarging the sphere of influence of the plume while reducing the concentration level of the plume interior.

Although there are no absolute boundaries defining the exact extent of the contaminant plume, individual concentration regimes can be followed. For the sake of this example, it is convenient to use the critical concentration of a contaminant as defined earlier in this report as the concentration regime of interest. Diachishin⁽²⁾ has obtained a three dimensional solution to the classical mass conservation equation:

$$\frac{\partial c}{\partial t} + u \frac{\partial c}{\partial x} + v \frac{\partial c}{\partial y} + w \frac{\partial c}{\partial z} = D_x \frac{\partial^2 c}{\partial x^2} + D_y \frac{\partial^2 c}{\partial y^2} + D_z \frac{\partial^2 c}{\partial z^2} \quad (1)$$

yielding:

$$C(x,y,z,t) = \frac{K}{t^{3/2}} \exp \left\{ -\frac{1}{4t} \left[\frac{(x-ut)^2}{D_x} + \frac{(y-Vt)^2}{D_y} + \frac{(z-wt)^2}{D_z} \right] \right\} \quad (2)$$

where C is the concentration of pollutant,
x,y,z refer to coordinates in a three dimensional box
u,v,w are velocities in the x,y,z directions, respectively,
D_x,D_y,D_z are diffusion coefficients,
t is time, and
K is a constant evaluated from boundary conditions.

Assuming that lateral and vertical velocities are negligible, the equation reduces to:

$$C(x,y,z,t) = \frac{K}{t^{3/2}} \exp \left\{ -\frac{1}{4t} \left[\frac{(x-ut)^2}{D_x} + \frac{y^2}{D_y} + \frac{z^2}{D_z} \right] \right\} \quad (3)$$

Using a specific critical concentration enables calculation of the boundary position at any time.

As an example, the diffusion pattern has been calculated for a spill of 1000 gallons of phenol at a point 300 meters offshore in both a moving and a stationary environment. The critical concentration level has been selected as 0.01 mg/l, the taste threshold of phenol.

Figure F-5 diagrams the position and size of the phenol spill at intervals of 6, 24 and 72 hours after the spill. A current of one knot and high eddy diffusivities have been assumed. Immediately after the spill, the affected area begins to grow in size. This growth continues until there is no longer enough phenol to produce a concentration 0.001 mg/l or more within the volume enclosed. At that time, the boundaries begin to recede. Meanwhile, the center of the spill continues to move downstream at the one knot velocity of the convection current. When the threshold boundaries recede to the center location, dilution is complete and the phenol can no longer be tasted, even though it is present in minute quantities over a wide area.

Figure F-6 depicts a similar spill incident into a body of water with no convection currents and low eddy diffusivities. In this case, the initial point of the spill remains as the center of the diffusing area throughout the dilution process. Because of the lower diffusivities, the contaminated volume is still growing after 72 hours. However, the threshold boundary of 0.001 mg/l will eventually reach a maximum size and then begin to recede as in the preceding case. When this boundary approaches the center point, dilution is complete.

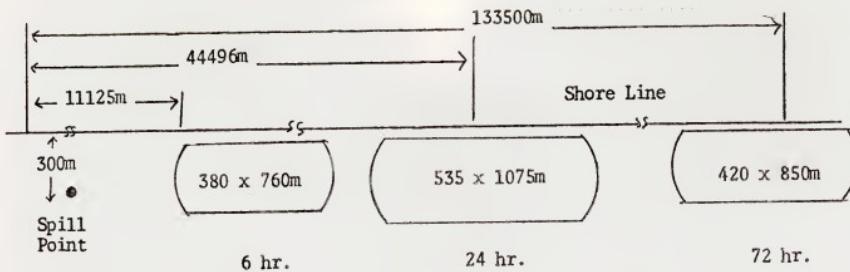
Although hypothetical, these examples serve to illustrate the general nature of natural dilution processes and the order of magnitude of the time frame necessary for dilution to reduce the concentration of a pollutant to innocuous levels.

Biological and Chemical Behavior of DDT

An example of the complicated route taken in the course of the environmental fate of one hazardous material, DDT, may serve to deepen appreciation of the nature of environmental interaction.

The behavior of most inorganic substances in natural waters will be ultimately dependent upon their elemental composition. Transformations of broad groups of the elements as well as important specific examples have been discussed. Although the discussion of carbon is generally applicable to organic materials entering surface waters, the important biological implications of carbonaceous compounds warrants their further consideration.

A general discussion of the fate of any compound in the environment must be qualified. Description of the "fate" of a given material must therefore consist of a series of assumptions based on pollutant behavioral measurements and quantitative data on the content of the compound in the various ecological compartments. The primary obstacle to efficient use of quantitative data on the extent of a given pollutant in any ecological compartment for predictive purposes is the lack of concomitant measurements of compartmental mass. Thus, present information is sufficient to establish background pollutant



Plume Boundary = 0.001 mg/l

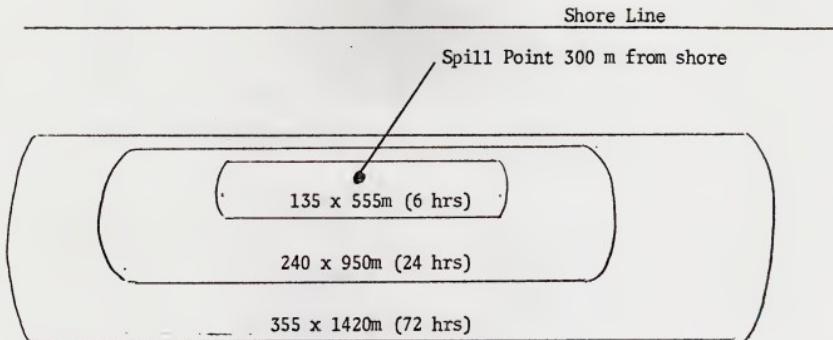
isoconcentration line

$$D_x = 0.4 \text{ m}^2/\text{Sec}$$

$$D_y = 0.1 \text{ m}^2/\text{Sec}$$

$$D_z = 0.005 \text{ m}^2/\text{Sec}$$

FIGURE F-5. Movement of a 1000 Gallon Phenol Spill - One Knot Current



Plume Boundary = 0.01 mg/ x
isocentration line

$$Dx = 0.1 \text{ m}^2/\text{Sec}$$

$$Dy = 0.05 \text{ m}^2/\text{Sec}$$

$$Dz = 0.00005 \text{ m}^2/\text{Sec}$$

FIGURE F-6. Movement of a 1000 Gallon Phenol Spill - No Current

levels for several compound types in the major ecological compartments, but is insufficient to predict the distribution of the pollutant as a percentage of that applied to a given system. Of the potential environmental pollutants, DDT has been the most studied. A relative paucity of data exists for the environmental effects of other pollutants. DDT is useful for study because it has been in widespread use longer than any other pesticide, and it has a wide interaction with all the potential transport pathways for man-made chemicals in the environment. The general reactions of other organic chemical pollutants in the aquatic environment may be expected to be analogous to DDT. However, the degree to which this analogy is valid can only be inferred from a detailed knowledge of the properties of the individual chemicals.

Delivery of DDT to the point of use presents the potential of collisions, fires, derailments and other stresses which may release large quantities of the material into the environment. Approximately 80% of the DDT tonnage is carried by trucks and motor carriers, 17% by rail and 3% by water.⁽⁶⁾ Furthermore, storage and actual use of the material for agriculture, forestry and municipal purposes provide further hazards for the entrance of excessive quantities of material into the environment.

The potential fate of DDT entering the aquatic environment follows that outlined in Figure 7. A model containing more detailed information with respect to DDT concentration mechanisms is outlined in Figure F-8. The values given indicate ranges of magnitude of DDT concentrations reported in environmental studies. ⁽⁸¹⁾ As much as 50% of the DDT entering water may be codistilled in 24 hours, ⁽¹¹⁾ representing a significant exit route from the aquatic system which is highly affected by relatively small changes in the temperature and DDT concentration.

For water solubility of DDT, as in the case with many of the chlorinated hydrocarbons, is quite low, not exceeding approximately 1 ppb. However, DDT is strongly sorbed to suspended particulate matter; consequently, water samples analyzed for DDT without prior removal of suspended matter may exceed 10 ppm. Therefore, the particulate complex is likely the major transport vehicle for DDT in the aquatic environment. Thus, the nature and importance of sedimented and suspended particulate matter in governing the fate of pollutants in water is well illustrated.

The solubility of DDT and other chlorinated hydrocarbons in oils is extremely high with respect to their solubility in water. In fact, DDT is 8×10^7 times more soluble in oils than in water. The environmental consequences of this characteristic are significant. DDT can readily pass through the cell membrane of an organism where it will remain as the intact molecule until decomposed after the death of the organism or until it is consumed by another life form. Thus, DDT is accumulated in increasing quantities in the aquatic food chain. The model of DDT in the aquatic ecosystem is therefore essentially a model of the food chain.

Plants and invertebrates obtain DDT directly or indirectly from bottom sediments, suspended solids, and water. Fish consuming the contaminated

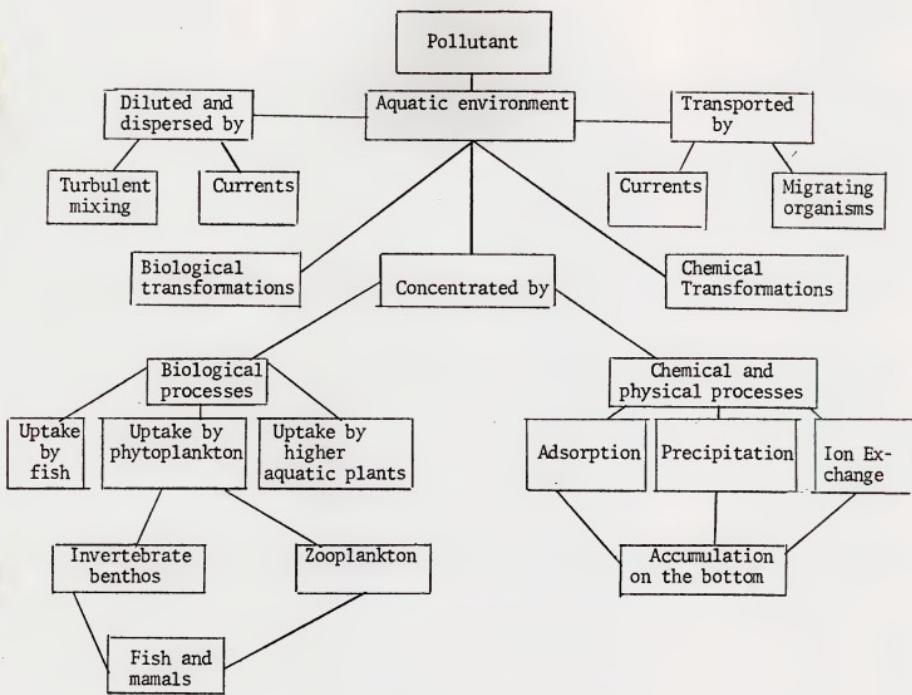


FIGURE 7. PROCESSES WHICH INFLUENCE THE DISTRIBUTION AND FATE OF POLLUTANTS ENTERING THE AQUATIC ENVIRONMENT (Modified from Ketchum (44))

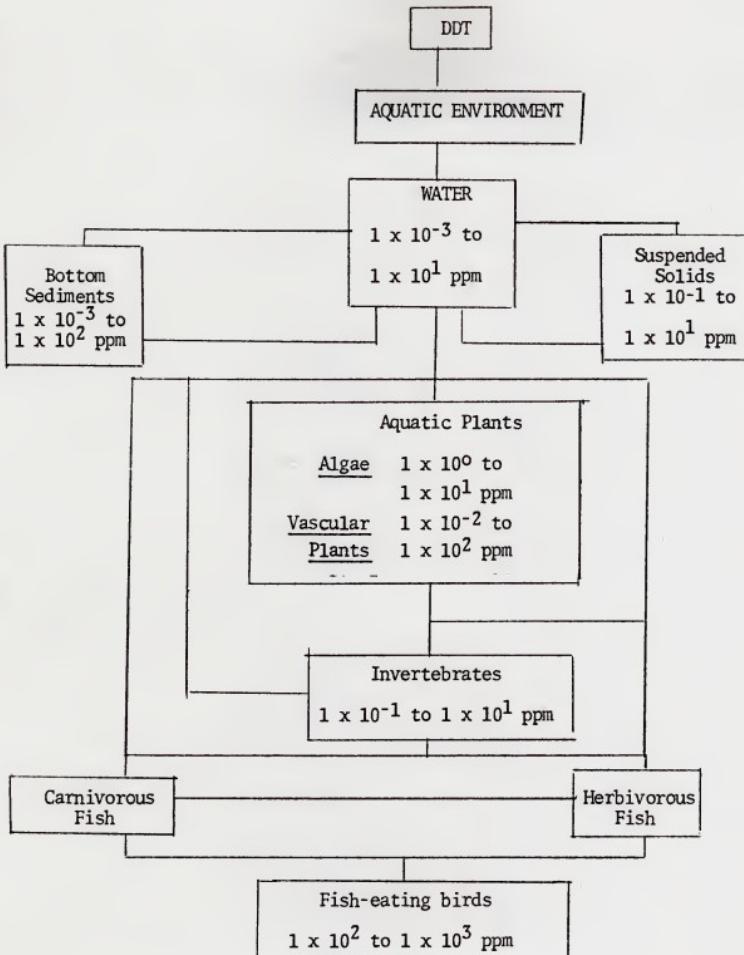


FIGURE F-8. Model of DDT in the Aquatic Ecosystem
(Modified from Schneider) (18)

lower forms concentrate the DDT of a relatively large quantity of food organisms. Birds consuming fish may contain DDT in quantities as high as 1×10^3 ppm.

The affinity of DDT for hydrophobic surfaces results in its direct uptake by many organisms, including fish, and therefore, strick accumulation in the food chain represents only a "simplified" model of potential mechanisms for entrance of DDT into the higher chain.

APPENDIX F

SYSTEM FOR NUMBERING LOCATIONS

Wells, springs, water-sampling locations and stream gaging locations are assigned numbers based on the system of land subdivision used by the U. S. Bureau of Land Management. This system will also be used to locate oil spills. The number consists of twelve characters and describes the location by township, range, section, and position within the section. Figure 9 illustrates the numbering method. The first three characters of the number give the township, the next three characters the range. The next two numbers give the section number within the township and the next three letters describe the location with the quarter section (160-acre tract) and the quarter-quarter section (40-acre tract), and the quarter-quarter-quarter section (10-acre tract). These subdivisions of the 640-acre section are designated a, b, c, and d in a counterclockwise direction, beginning in the northeast quadrant. If there is more than one feature in a 10-acre tract, consecutive digits beginning with 2 are added to the number. For example, if a water quality sample was collected in sec. 21, T9N, R20W, it would be numbered 09N20W21DAA2. The letters DAA indicate that the well is in the NE 1/4 of the NE 1/4 of the SE 1/4, and the number 2 following the letters DAA indicates there is more than one water quality sampling location in this 10-acre tract.

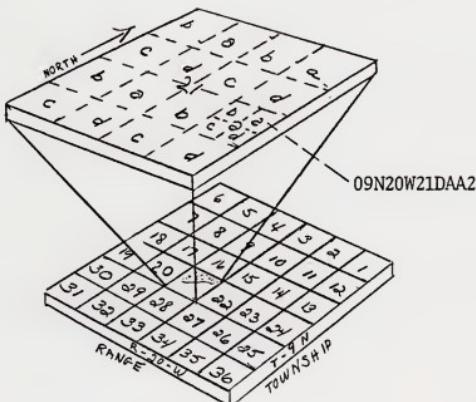


Figure 9 - Sketch showing system of numbering hydrologic features.

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